FIFTH BIENNIAL REPORT

OF THE

STATE BOARD OF HEALTH

OF

CALIFORNIA,

FOR THE YEARS 1878 AND 1879.

SACRAMENTO:
STATE OFFICE : : : F. P. THOMPSON, SUPT. STATE PRINTING.
1879.


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REPORT

OF THE

STATE BOARD OF HEALTH.

MEMBERS OF THE STATE BOARD OF HEALTH.

HENRY GIBBONS, SR., M. D., President.....San Francisco.
F. WALTON TODD, M. D. .....Stockton.
A. B. STOUT, M. D.....San Francisco.
LUKE ROBINSON, M. D.....Colusa.
J. S. CAMERON, M. D. .....Red Bluff.
J. F. MONTGOMERY, M. D.....Sacramento.
F. W. HATCH, SR., M. D.....Sacramento.

COMMITTEES OF THE STATE BOARD OF HEALTH.

On the Salubrity of Public Institutions, Schools, Hospitals, Prisons, Factories, etc.—Drs. A. B. STOUT, J. F. MONTGOMERY, and F. WALTON TODD.

On Statistics Relating to Life and Health, Modes of Employment and of Living, and the Comparative Healthfulness of Different Localities.—Drs. F. WALTON TODD, J. S. CAMERON, H. GIBBONS, Sr., and LUKE ROBINSON.

On Intoxicating Liquors, Inebriate Asylums, Pathological Influence of Alcohol, etc.—Drs. H. GIBBONS, Sr., J. S. CAMERON, and J. F. MONTGOMERY.

Of these committees the Secretary of the Board is *ex officio* a member.

REPORT.

To His Excellency, William Irwin, Governor of California:

The State Board of Health respectfully present herewith their fifth biennial report.

The sanitary condition of the State during the past two years, and the efforts of the Board to ameliorate the same, have been detailed in the report of the Permanent Secretary.

By a system of reports from voluntary correspondents we have been kept informed of the healthfulness, as well as of the rise and progress of disease in different localities throughout the State, and we have endeavored, by bi-monthly bulletins, to convey this information to others.

Investigations have been commenced into the sewerage and water supply of the cities and towns of California, and the results, as far as the work has progressed, are given in the present report, together with a few reflections which seemed pertinent to these subjects.

The prescribed limits of this report forbid a more extended allusion to these important questions at this time. They might be profitably continued in the next biennial report, when additional analyses, especially of the well water supplied to many of the towns of the State, might be given. The sentiment is becoming more and more deeply impressed upon sanitarians that there exists an intimate relation between the drinking water of a community and certain serious and quite prevalent diseases, and the correctness of this opinion has been demonstrated by many facts both in this country and in Europe; hence the importance of a thorough investigation of the subject.

The attention of your Excellency is called to the several papers accompanying the report of the Permanent Secretary, prepared by different members of the Board of Health. They treat of subjects important in a hygienic point of view, and instructive to the people in matters involving the sanitary welfare of the State. The consideration of these and kindred subjects of public interest is one of the duties of the State Board of Health, and it is by the dissemination of such information that its highest mission is to be fulfilled.

It is not too much to believe that some public benefit has already been accomplished by the publications of this Board. For their full fruition we must look to the future. The good effects of sanitary work must, of necessity, be of slow growth. The public mind has to be educated upon this subject. Sanitary science cannot at once accomplish what she seeks to do. Prohibitory laws—coercive measures—can never be effectually enforced unless sustained by an enlightened public sentiment. To encourage and promote such a sentiment is one of the chief aims of the science. It is its first step towards complete success. This it seeks to do by the gradual process

of education, by disseminating truth, by calling attention to error, by scattering abroad over the land the results of observation or the deductions of reason, by sowing seeds which, though they may, to all appearances, lie dormant for a time, will ultimately germinate and bear abundant harvests. Hence Boards of Health are not to be condemned or thought of doubtful utility because immediate results do not follow; but it can no more happen that the knowledge spread abroad among the people by their instrumentality should prove altogether barren, than that the grain of wheat planted in its season should fail to spring into life and bear fruit.

STATEMENT

Of the condition of the appropriations for mileage and contingent expenses of the State Board of Health for 29th and 30th fiscal years.

TWENTY-NINTH FISCAL YEAR, ENDING JUNE 30TH, 1878.

Appropriation	$1,500 00
Expended, as per vouchers in Controller's office	867 00
Balance unexpended	$633 00

THIRTIETH FISCAL YEAR, ENDING JUNE 30TH, 1879.

Appropriation	$1,000 00
Expended, as per vouchers in Controller's office	605 90
Balance unexpended	$394 10

Leaving an unexpended balance in the appropriation for the 29th and 30th fiscal years of $1,027 10.

REPORT OF THE PERMANENT SECRETARY

TO THE

STATE BOARD OF HEALTH.

REPORT OF PERMANENT SECRETARY.

To the State Board of Health:

GENTLEMEN: It becomes the duty of your Secretary again to present for your consideration his biennial report.

A review of the past two years affords the gratifying evidence of an improved sanitary condition of the State, and this is especially observable in the mortality by zymotic diseases and among the infantile population.

One of the most favorable results of the work of this Board has been a gradually increasing interest in the subject of the public health, manifested by the establishment of local health boards in different parts of the State. The Act of the last Legislature requiring the organization of these boards has met with a very general approval, and already has resulted in the formation of auxiliary boards in fifteen towns and cities, viz.: Chico, San Luis Obispo, San Diego, Hayward, Vallejo, Sonora, Visalia, Santa Rosa, Petaluma, Santa Barbara, Red Bluff, Colusa, San Buenaventura, Los Angeles, and Tulare County. In addition to these, we have the previous boards of San Francisco, Sacramento, Oakland, and Stockton, making nineteen in all. Of these, eleven have placed themselves in communication with the State Board.

It is believed that it would materially add to the regularity of the reports from the local Boards of Health, if blanks for returns of deaths and births were forwarded by the State Board for distribution among physicians of each town where local organizations have been formed, except in the large cities, where these returns are regulated by municipal law. To enlist the cöoperation of medical men engaged in active professional duties in such reports, the labor to be performed must be reduced to a minimum. Even the work of writing out a certificate of a birth or death is of some moment to the busy practitioner. Simply filling up a printed blank materially lessens the burden. An effort will be made to accomplish this during the present year.

Your Secretary takes pleasure in congratulating you upon the final success of the efforts so urgently made by the American Medical Association and others for the creation, by Congress, of a National Board of Health—a success due in very great degree to the terrible epidemic of yellow fever which devastated so large an extent of the southern and southwestern portion of the United States. The necessity of such a Board was thus forcibly demonstrated, and commanded the assent of an hitherto lukewarm or unwilling National Legislature. Communication has already been partially established between this State Board and the national organization at Washington, and an effort will be made to obtain, from at least a portion of our cities and towns, weekly reports of deaths and diseases, thereby enabling

us more fully to coöperate with them in the preparation and issuance of a bulletin of prevalent diseases in all parts of the United States. The importance of the object is worthy an effort for accomplishment.

In pursuance of its duty to instruct the people in matters pertaining to their sanitary welfare, the State Board of Health have issued circulars upon public hygiene, which have been generally circulated directly from this office and through the press. One of these, October, 1877, related to the precautions deemed necessary to be observed in view of the extensive prevalence of diphtheria at that time. The other was designed to allay the apprehensions just then arising in the public mind, especially in the central valleys along the line of railroad communication with the States east of us, of the appearance of yellow fever in this State. These apprehensions were suddenly increased by the reported outbreak of the disease on a car at or near Reno, in the State of Nevada, in a family of emigrants from Memphis, Tennessee. Whatever foundation there may have been for the suspicion of the disease having been yellow fever, strict precaution was taken by the Central Pacific Railroad Company, the car detached from the train, and after the death of the sick person the passengers transferred to another car and permitted to pursue their journey westward. The low temperature prevailing at Reno during the delay there was certainly not favorable, according to the usual history of yellow fever, to the vitality of the germ. Upon the arrival of the suspicious car near Sacramento it was quarantined, and the passengers submitted to a strict examination. Although one or two of the remaining members of the emigrant family were slightly sick upon their arrival here, there seemed to be no reason for their detention.

In addition to these circulars of the State Board, bi-monthly bulletins have been issued containing abstracts of the reports of deaths and "prevalent diseases" in a number of towns and cities of the State. These have been distributed to the local health boards and to the correspondents of the Board, as well as to various Boards of Health in other States.

The attention of the State Board of Health is called to the subject of the law concerning the registration of deaths, births, and marriages. The difficulties encountered in other States have been repeated in this; and though the result since the passage of this amended law at the last session of the Legislature has been an improvement upon that obtained under the former Act, it will scarcely warrant the attempt to classify the statistics received in the hope of drawing any useful inferences therefrom. Blanks were sent to the Recorder of each county, both for his own report and for the returns of physicians to him. It is but just to several of these officers to state that they have discharged their duties faithfully, both in the distribution of the blanks sent and in making their returns to this office, but the facts contained are so few as to deprive many of them of any great practical value. The complaint has been that the physicians failed to forward their reports to the Recorder's office.

It is suggested that a meeting of the Board of Health be set apart for the consideration of this subject, in the hope of devising some plan more acceptable to the physicians of the State.

MORTALITY AND VITAL STATISTICS.

The statistics of the past two years compare favorably with those of previous years, notwithstanding the greater number of localities reporting and the natural increase of population. It is a subject for congratulation that, with the exception of a few months at the close of 1878 and in the beginning of 1879, no extraordinary causes of disease have extensively prevailed, no prolonged heated term, no widespread epidemics. For the purpose of showing the mortality and its causes, a tabular statement has been made of all the reports received at the office of the Board. Although the period embraced is, for some localities, only a fraction of a year, the returns have been included in the "table," thereby extending the area under review and exhibiting to the fullest possible extent the mortality actually occurring.

It is to be regretted, so long as the law requiring the registration of deaths is unenforced, that a greater regularity has not been observed in the reports of correspondents. Yet there is a manifest improvement in this respect. The reports for 1878 have been more regular than those for 1877; and, as the local Health Boards become more generally and more perfectly organized, it is believed a still greater accuracy and regularity will be gradually attained.

As the value of these reports and the statistics they embrace must depend mainly upon the correctness with which they have been made, it is proper here to state that we have associated with us in this work a list of medical gentlemen upon whose judgment, it is believed, we may confidently rely, and to whom, as volunteers in the cause, the thanks of the State Board of Health are fitly due. Some of them have been engaged in making reports ever since the organization of the Board in 1870; others have more recently joined them, and of the very large majority it may be said that a real interest is manifested that accuracy and punctuality may be secured.

Carried forward	3,269	1,626	1,310	60	1,201	499	208	440	322	102	151	12	12	1,804	600	810	89

Report of Deaths

For the Year ending December 31st, 1877, arranged to show the Number Dying by Each Disease, with their Sexes, Ages, and Nativities.

Causes of Death.	Total.	Sexes.			Ages.									Nativities.			
		Male.	Female.	Unascertained.	Under five years.	Five and under ten years.	Ten and under twenty years.	Twenty and under thirty years.	Thirty and under forty years.	Forty and under fifty years.	Fifty and under sixty years.	Sixty and under one hundred years.	Unascertained.	Pacific States.	Atlantic States.	Foreign countries.	Unascertained.
I.—Zymotic or Epidemic.																	
Cholera																	
Cholera morbus	16	12	4		5		1	2	2	3	2	1		5	3	8	
Cholera infantum	162	91	70	1	159	1	1						1	156	5	1	
Diarrhœa	39	23	15	1	30	1		1		5	1		1	30	3	4	2
Dysentery	33	16	15	2	20		2	2	4		1	2	2	21	5	4	3
Small-pox	238	149	89		68	41	28	50	32	12	5	2		132	34	71	1
Measles	20	12	7	1	12	4	3						1	15	4		1
Scarlatina	56	20	36		36	9	5	1	1				4	41	3	8	4
Diphtheria	1,163	593	535	35	678	375	50	17	2	4	2	1	34	987	102	39	35
Croup	121	58	57	6	95	22	1						3	103	11	4	3
Whooping-cough	39	21	17	1	38								1	37		1	1
Erysipelas	25	14	10	1	8	1	1	2	1	5	6		1	10	4	10	1
Fevers—Typhus																	
Typhoid	292	168	115	9	30	27	49	94	33	25	7	12	15	95	63	123	11
Remittent and intermittent	46	29	15	2	17	4	1	7	7	4	5	1		20	9	13	4
Cerebro-spinal	45	28	16	1	29	6	3	3	1	2	1			35	6	4	
Alcoholism (direct or remote)	63	49	13	1				4	17	24	14	3	1	2	20	34	7
II.—Constitutional Diseases.																	
Tuberculosis, including phthisis pulmonary	911	545	361	5	26	8	63	263	222	178	93	50	8	115	294	486	16
Carried forward	3,289	1,828	1,375	66	1,251	499	208	446	322	762	137	72	72	1,804	566	810	89

Report of Deaths

For the Year ending December 31st, 1877, arranged to show the Number Dying by Each Disease, with their Sexes, Ages, and Nativities.

Causes of Death.	Total	Sexes.			Ages.									Nativities.			
		Male	Female	Unascertained	Under five years	Five and under ten years	Ten and under twenty years	Twenty and under thirty years	Thirty and under forty years	Forty and under fifty years	Fifty and under sixty years	Sixty and under one hundred years	Unascertained	Pacific States	Atlantic States	Foreign countries	Unascertained
I.—Zymotic or Epidemic.																	
Cholera																	
Cholera morbus	16	12	4		5		1	2	2	3	2	1		5	3	8	
Cholera infantum	162	91	70	1	159	1	1						1	156	5	1	
Diarrhœa	39	23	15	1	30	1		1		5	1		1	30	3	4	2
Dysentery	33	16	15	2	20		2	2	4		1	2	2	21	5	4	3
Small-pox	238	149	89		68	41	28	50	32	12	5	2		132	34	71	1
Measles	20	12	7	1	12	4	3						1	15	4		1
Scarlatina	56	20	36		36	9	5	1	1				4	41	3	8	4
Diphtheria	1,163	593	535	35	678	375	50	17	2	4	2	1	34	987	102	39	35
Croup	121	58	57	6	95	22	1						3	103	11	4	3
Whooping-cough	39	21	17	1	38								1	37		1	1
Erysipelas	25	14	10	1	8	1	1	2	1	5	6		1	10	4	10	1
Fevers—Typhus																	
Typhoid	292	168	115	9	30	27	49	94	33	25	7	12	15	95	63	123	11
Remittent and intermittent	46	29	15	2	17	4	1	7	7	4	5	1		20	9	13	4
Cerebro-spinal	45	28	16	1	29	6	3	3	1	2	1			35	6	4	
Alcoholism (direct or remote)	63	49	13	1				4	17	24	14	3	1	2	20	34	7
II.—Constitutional Diseases.																	
Tuberculosis, including phthisis pulmonary	911	545	361	5	26	8	63	263	222	178	93	50	8	115	294	486	16
Carried forward	3,289	1,828	1,375	66	1,251	499	208	446	322	762	137	72	72	1,804	566	810	89

Report of Deaths

For the Year ending December 31st, 1877, arranged to show the Number Dying by Each Disease, with their Sexes, Ages, and Nativities.

2d

Causes of Death.	Total.	Sexes.			Ages.									Nativities.			
		Male.	Female.	Unascertained.	Under five years.	Five and under ten years.	Ten and under twenty years.	Twenty and under thirty years.	Thirty and under forty years.	Forty and under fifty years.	Fifty and under sixty years.	Sixty and under one hundred years.	Unascertained.	Pacific States.	Atlantic States.	Foreign countries.	Unascertained.
I.—Zymotic or Epidemic.																	
Cholera																	
Cholera morbus	16	12	4		5		1	2	2	3	2	1		5	3	8	
Cholera infantum	162	91	70	1	159	1	1						1	156	5	1	
Diarrhœa	39	23	15	1	30	1		1		5	1		1	30	3	4	2
Dysentery	33	16	15	2	20		2	2	4		1	2	2	21	5	4	3
Small-pox	238	149	89		68	41	28	50	32	12	5	2		132	34	71	1
Measles	20	12	7	1	12	4	3						1	15	4		1
Scarlatina	56	20	36		36	9	5	1	1				4	41	3	8	4
Diphtheria	1,163	593	535	35	678	375	50	17	2	4	2	1	34	987	102	39	35
Croup	121	58	57	6	95	22	1						3	103	11	4	3
Whooping-cough	39	21	17	1	38								1	37		1	1
Erysipelas	25	14	10	1	8	1	1	2	1	5	6		1	10	4	10	1
Fevers—Typhus																	
Typhoid	292	168	115	9	30	27	49	94	33	25	7	12	15	95	63	123	11
Remittent and intermittent	46	29	15	2	17	4	1	7	7	4	5	1		20	9	13	4
Cerebro-spinal	45	28	16	1	29	6	3	3	1	2	1			35	6	4	
Alcoholism (direct or remote)	63	49	13	1				4	17	24	14	3	1	2	20	34	7
II.—Constitutional Diseases.																	
Tuberculosis, including phthisis pulmonary	911	545	361	5	26	8	63	263	222	178	93	50	8	115	294	486	16
Carried forward	3,289	1,828	1,375	66	1,251	499	208	446	322	762	137	72	72	1,804	566	810	89

Report of Deaths—Continued.

Causes of Death.	Total.	Sexes.			Ages.									Nativities.			
		Male.	Female.	Unascertained.	Under five years.	Five and under ten years.	Ten and under twenty years.	Twenty and under thirty years.	Thirty and under forty years.	Forty and under fifty years.	Fifty and under sixty years.	Sixty and under one hundred years.	Unascertained.	Pacific States.	Atlantic States.	Foreign countries.	Unascertained.
Brought forward	3,289	1,828	1,375	66	1,251	499	208	446	322	762	137	72	72	1,804	566	810	89
III.—Local Diseases.																	
Pneumonia	369	228	138	3	104	19	13	32	43	63	46	45	4	125	70	163	11
Pleurisy	6	6					1	1		2	1	1			3	3	
Bronchitis	67	46	21		42	1		3	3	6	5	7		37	12	18	
Other diseases of respiratory organs	147	99	44	4	45	5	2	16	13	25	18	21	2	50	28	63	6
Diseases of stomach and bowels	305	176	126	3	125	11	7	28	35	50	23	23	3	141	53	105	6
Diseases of the liver	111	70	37	4	5	1	1	12	19	33	25	13	2	12	38	58	3
Bright's disease and nephritis	86	54	30	2	1	3	1	16	23	24	9	7	2	7	29	47	3
Aneurism	36	33	3					6	15	10	4	1			13	21	2
Heart diseases	241	155	84	2	11	9	18	21	41	61	42	36	2	30	59	142	10
Diseases of brain and nervous system	756	446	299	11	391	33	14	32	57	71	70	79	9	416	115	201	24
Rheumatism	15	8	6	1	2		2		4		6	1		3	2	10	
IV.—Developmental Diseases.																	
Puerperal diseases	56		56				2	19	23	9			3	9	8	36	3
Persons dying over seventy years of age	27	11	15	1								27		8	5	11	3
V.—External Causes.																	
Heat—death from sunstroke	3		2	1	1						1		1	2			1
All other causes not classified	2,020	1,299	642	79	643	58	82	264	311	251	156	158	97	693	224	1,043	60
Totals	7,514	4,459	2,878	177	2,621	639	351	896	909	867	543	491	197	3,337	1,225	2,731	221
Stillborns	295	152	114	29													

Report of Deaths

For the Year ending December 31st, 1878, arranged to show the Number Dying by Each Disease, with their Sexes, Ages, and Nativities.

Causes of Death.	Total.	Sexes.			Ages.									Nativities.			
		Male.	Female.	Unascertained.	Under five years.	Five and under ten years.	Ten and under twenty years.	Twenty and under thirty years.	Thirty and under forty years.	Forty and under fifty years.	Fifty and under sixty years.	Sixty and under one hundred years.	Unascertained.	Pacific States.	Atlantic States.	Foreign countries.	Unascertained.
I.—Zymotic or Epidemic.																	
Cholera																	
Cholera morbus	7	4	3		1		2	1	1	2				2		4	1
Cholera infantum	177	98	74	5	172	3	1						1	173			4
Diarrhœa	48	25	23		29	1	2		3	4	6	2	1	30	7	11	
Dysentery	39	21	18		19	1	2	4	1	3	5	2	2	19	6	9	5
Small-pox	1	1			1										1		
Measles	63	34	29		58	2	1	2						58	3	2	
Scarlatina	38	14	24		25	11	1	1						37		1	
Diphtheria	363	168	169	26	187	127	22					1	26	277	38	10	38
Croup	69	33	36		56	12				1				62	4	3	
Whooping-cough	59	24	34	1	57	1							1	55	3		1
Erysipelas	9	8	1					4	1	2	1	1			2	7	
Fevers—Typhus	3	1	2		1		2							3			
Typhoid	205	119	85	1	34	20	36	42	35	15	16	7		79	50	70	6
Remittent and intermittent	53	27	26		12	4	1	8	11	9	5	2	1	19	8	25	1
Cerebro-spinal	43	21	21	1	27	3	4	2	1	3		1	2	34	5	2	2
Alcoholism (direct or remote)	54	39	13	2	1			1	14	18	10	7	3	1	11	38	4
II.—Constitutional Diseases.																	
Tuberculosis, including phthisis pulmonary	1,030	644	372	14	33	12	74	236	275	216	119	43	22	144	277	562	47
Carried forward	2,261	1,281	930	50	713	197	158	301	342	273	162	66	59	993	415	744	109

Report of Deaths—Continued.

Causes of Death.	Total	Sexes.			Ages.									Nativites.			
		Male	Female	Unascertained	Under five years	Five and under ten years	Ten and under twenty years	Twenty and under thirty years	Thirty and under forty years	Forty and under fifty years	Fifty and under sixty years	Sixty and under one hundred years	Unascertained	Pacific States	Atlantic States	Foreign countries	Unascertained
Brought forward	2,261	1,281	930	50	713	197	158	301	342	273	162	66	59	993	415	744	109
III.—Local Diseases.																	
Pneumonia	447	270	168	9	147	14	14	37	64	65	53	48	5	162	94	175	16
Pleurisy	5	4	1		1	1			3					2		3	
Bronchitis	86	43	42	1	53	4	1	1	3	2	9	12	1	58	6	22	
Other diseases of respiratory organs	134	92	42		40	2	3	13	19	22	19	15	1	47	19	66	2
Diseases of stomach and bowels	280	156	119	5	99	8	17	18	33	50	27	26	2	122	59	94	5
Diseases of the liver	114	77	32	5	6	2	3	10	25	25	23	19	1	11	31	63	9
Bright's disease and nephritis	71	51	20		3		2	9	12	18	10	15	2	9	19	37	6
Aneurism	38	33	5					3	9	9	12	5		1	12	21	4
Heart diseases	283	181	98	4	11	4	15	25	40	66	74	45	3	42	83	153	5
Diseases of brain and nervous system	709	433	268	8	348	30	21	27	51	73	80	73	6	370	121	189	29
Rheumatism	14	10	4				2		2	4	3	3		3	3	7	1
IV.—Developmental Diseases.																	
Puerperal diseases	57		57				7	20	26	4				11	12	29	5
Persons dying over seventy years of age	50	24	16	10								47	3	2	22	11	15
V.—External Causes.																	
Heat—death from sunstroke	5	5									1		4			5	
All other causes not classified	2,035	1,324	624	87	614	30	63	271	334	256	172	181	114	684	233	970	148
Unknown	62	6	14	42	11	3	3	1		1		1	42	19		1	42
Totals	6,651	3,990	2,440	221	2,046	295	299	736	963	868	645	556	243	2,536	1,129	2,590	396
Stillborns	336	201	127	8													

The mortality table for 1877 shows a total of 7,507 deaths, of which 1,449 were by the zymotic class, while the total for 1878 is 6,651, and the deaths by zymotic diseases 1,231. In the former year 2,621 children died under five years of age, or 34 per cent. of the mortality; in the latter, 2,046 died before they reached their fifth year, or 30 per cent. The zymotic diseases alone included 1,225 children under five years of age in 1877, while in 1878, of the victims of the same class, 680 were under five years of age.

This is the result obtained from the reports from all parts of the State. If we regard only those from the larger cities we find in 1877 that San Francisco, with its probable population at that time of 275,000 souls, furnished 2,019 deaths under five years of age, or .07 per cent.; Sacramento, with 24,000 population, 139, or .057 per cent.; Stockton, with 13,000, 36, or .027 per cent.; Los Angeles, with 14,000, 121, or .086 per cent.; Santa Barbara, with 5,500, 36, or .06 per cent.; Santa Cruz, with 5,000 population, 18, or .03 per cent.; and Marysville, with 7,000 population, 23, or .03 per cent.

For 1878 a similar statement, based upon the reported population of these same cities, gives .053 per cent. for San Francisco, estimating the population at 300,000; .043 per cent. for Sacramento; .011 per cent. for Stockton; .028 per cent. for Los Angeles; .06 per cent. for Santa Barbara; .023 per cent. for Santa Cruz; and .037 per cent. for Marysville; showing a difference in the total percentages in favor of the latter year of nearly .11 per cent. This is particularly gratifying, as the deaths in infancy may generally be considered indicative of the prevalence of zymotic diseases and the presence of their exciting causes. Thus, while CHOLERA INFANTUM numbered 237 victims in 1876, according to the last biennial report, the mortality by this cause in 1877 was only 162, and 177 in 1878. Of the latter, 143 were in the three Cities of San Francisco, Sacramento, and Los Angeles. SCARLATINA has passed lightly over our youthful population, being the reported cause of only 56 deaths in 1877, and 38 in 1878; while MEASLES yields a total of 20 and 63 respectively.

INFLAMMATORY DISEASES OF THE PULMONARY ORGANS—EIGHTEEN HUNDRED AND SEVENTY-SEVEN.

Of the pulmonary diseases PNEUMONIA stands prominent as a cause of mortality—369—while bronchitis is accountable for only 67. Distributing the cases of both these diseases, according to their localities, we find 349 to have occurred in the coast division, San Francisco alone being responsible for 337; 15 in the coast valleys; 61 in the interior valleys, and 11 in the mountains.

EIGHTEEN HUNDRED AND SEVENTY-EIGHT.

At no period since the organization of the State, so far as its medical history is known, have affections of the organs of respiration been quite as prevalent as during the latter part of 1878. Commencing in or about November, in a few localities, as a simple influenza or bronchitis, the area within which its influence was felt gradually widened until nearly all parts of the State, from which reports have been received, were very sensibly affected. Nor has it been confined to this simple form of disease; the epidemic influence seemed to gain vigor as it progressed and persisted; the vital resist-

ance of the people became perceptibly diminished, and it manifested itself by an increased severity in the type of the disease, by pneumonia in children and debilitated subjects, and especially in those advanced in life. Among the latter it assumed a decidedly asthenic form, and was sometimes rapidly fatal.

There seems, indeed, to have been at the time a marked tendency to the disease under consideration throughout many portions of the United States, and even in the Old World—one of those cycles of which the history of disease affords many examples, and which possess a deep interest not only in themselves but because they are sometimes the precursors of other and more serious epidemic influences. It would be unprofitable, without more extended research than the limits of this report would permit, to theorize upon the causes to which the recent prevalence of these diseases in California is to be attributed. The prominent meteorological conditions observed were an unusual predominance of northwest winds, a highly electrical condition of the atmosphere, and a continuously lower temperature than had ever, or almost ever, been experienced here. During October, November, and December, 1878, and January and February, 1879, the prevailing wind at Sacramento was northerly during 112 days, or an average of 22.5 days monthly, against 19 days for the same months during the preceding year, and about 18 days in 1876. The mean temperature of December, 1878, and January, 1879, calculated from the maxima and minima, was 44.6° and 45.6° respectively, against 47.9° for December, 1877 (record for January, 1878, lost), and 48° in December, 1876, and 50.3° in January, 1877. In December, 1878, there were 19 days with a minimum temperature below 32°, and 13 days in January, 1879. In the former month the minimum temperature fell on one day to 20°, and was 25° or less for eight days. The eucalyptus trees, some young orange and lemon trees, and several other varieties, which commonly bear well our winter temperature, suffered severely—some have perished irrecoverably. The same phenomena were witnessed as far south as Los Angeles.

Arranging the diseases under consideration according to their localities, we observe 404 on or near the coast, including San Francisco, 34 in the coast valleys, 90 in the interior valleys, and 5 in the mountains. Comparing the mortality by months for the twelve months ending April, 1879, with the previous twelve months, the following result is obtained:

TABLE.

Showing Deaths by Acute Respiratory Diseases, April, 1877, to March 31st, 1878, in 37 Localities.

April	May	June	July	August	September	October	November	December	January	February	March
35	33	30	3	30	33	26	33	41	81	50	58

TABLE.

Showing Deaths by Acute Respiratory Diseases, April, 1878, to March 31st, 1879, in 38 Localities.

April	May	June	July	August	September	October	November	December	January	February	March
49	48	32	22	20	29	33	35	70	125	71	39

ALCOHOLISM.

Fifty-two deaths are reported as by alcoholism, viz., 38 males and 13 females—the sex of one being unascertained. Two facts are noticeable in connection with this disease, as shown by the mortality table, that of the nativities of the deceased 37 were foreign born, and that of these none were Chinese; of the remainder, 5 were born on the Pacific Coast and 10 in the Atlantic States. The exemption, so far as it appears of the Chinese from the fatal effects of this vice, is somewhat remarkable, when it is known that in some of the cities intemperance and alcoholism, in their most disgusting features, are frequently the result of the free indulgence in "Chinese brandy"—made in China of rice—a most "villainous stuff," intensely intoxicating, but resorted to on account of its cheapness. It is a common remark that a man can sooner get drunk on five cents invested in "Chinese brandy" than from many times that amount expended in the common liquors of home manufacture. It bears the same relation to ordinary liquors that nitro-glycerine does to gunpowder. That the Chinese themselves do not use it to greater excess is due, perhaps, to their knowledge of its deleterious properties, and, possibly, to the control that the heads of the companies exercise over them.

FEVERS—EIGHTEEN HUNDRED AND SEVENTY-SEVEN.

The only fevers whose prevalence justifies particular reference are classified as typhus and typhoid, and remittent and intermittent. The former is almost a misnomer as applied to the fevers of California, very few cases having ever been observed here. In fact the common term typho-malarial would probably cover a large majority of what are set down in the reports as typhus and typhoid. The whole mortality by this class is seen to have been 292, of which 214 were in the coast towns, including San Francisco; 38 in the coast valleys; 33 in the interior valleys; and 7 in the mountains.

Intermittent and remittent fevers, though far more prevalent than the above, if we regard the entire State, are differently arranged as to localities. The entire mortality is set down at 46, of which 22 were near the coast (at San Francisco); 8 in the coast valleys; 15 in the interior valleys; and 1 in the mountains.

Of the fevers of California, Dr H. Worthington, one of our correspondents, has furnished an account in his report from Los Angeles:

FEVER IN SOUTHERN CALIFORNIA.

The last report of the California State Board of Health records a mortality of four hundred and six against fevers. The classification for statistical purposes is sufficient. But in every locality there are special and characteristic forms of fever observed by the local practitioner which, in themselves, differ materially as regards symptomatology, prognosis, and treatment, from the accepted orthodox types. Southern California offers no exception to this rule. Indeed, the peculiar forms of disease that are, as it were, indigenous to a climate acknowledged as exceptionally excellent, ought to be more or less familiar to the profession. For the death-rate may not be a true indication of the prevalence of disease in a given locality, as instanced in Dr. Hatch's report in the case of Yreka, Siskiyou County, where malarial diseases prevail "to the extent of seventy-five cases in the hundred" during certain months, and yet the mortality, from all fevers combined, is only four. And so it may be said, if the combined mortality of fever in Santa Barbara and Los Angeles is only thirty-six, these figures do not settle the question of the immunity of the localities mentioned from malaria.

The statistics of the State Board have established this fact, that malaria is found everywhere throughout California, and the conditions surrounding the etiology are about the same everywhere, for this paludal poison is not confined to the valleys and moist lands, but is present as well in our foothills, in our dryest *mesas*, and on the highest mountains. Still, of the true malarial types the cases are few, mostly imported, this side of Bakersfield. Essential fevers are rarely seen. The specific typhoid fever is an exceedingly rare disease. The majority of cases reported as typhoid, when investigated, fail to reveal specific lesions of the pythogenic disease. The same observation applies also to typhus fever. Woodward's disease, called typho-malarial fever, is the prevailing continued fever. It is met with most frequently during the summer months. The symptoms, as observed here in an ordinary case of this affection, correspond to this description: "Daily remissions and exacerbations, rarely intermissions, and gradually, after a few days, the fever becomes continued, so that a typhoid condition, sometimes adynamic, is established." A typical case is difficult to picture, for the reason that in some cases the malarial element is predominant, and in other cases evidences of septic poisoning are unmistakable. The skin is more or less pigmented, of a brownish yellow hue; the face wears a listless expression; the tongue is generally red and dry, rarely brown; and there may or may not be sordes; the breathing is hurried, and there is often a cough with mucous sputa. The heart is usually involved, denoted by feeble impulse and ventricular debility, either at apex or base. The spleen is enlarged, hepatic tenderness is marked. The abdomen is tympanitic, but rarely tender, and constipation is oftener present than diarrhœa. Pains in the bones, headache, and quiet delirium are often present. These symptoms are representative of an uncomplicated case. There have been reported a few cases of congestive chill, followed by an attack of this fever. A certain periodicity may generally be noticed as regards the chill. A cold stage may come on regularly every day, or every third day, if unanticipated by quinine, throughout the course of the disease—a symptom so characteristic as to be almost diagnostic. In the course of a few cases the violent pains in the bones, succeeded by fever and sweating, are suggestive of relapsing fever, inasmuch as these symptoms recur at intervals of a few days.

More than one practitioner in this neighborhood would look on typho-malarial fever as an essential disease—indeed, the peculiar pathological lesions, the thermometric curve, and the symptomatology would give color to this belief.

The classic chill and fever is rarely met with here, except, perhaps, along the river bottoms and among some of the *cienegas*. Instead, "masked fever" and "dumb ague" are common. Patients may suffer a long time with the latter, which many methods of treatment fail to cure. Nethertheless, a change of air is generally effective—those inland going to the seaside; those near the sea resorting to the mountains and foothills. The best prophylactic against dysentery, malarial, typho-malarial, and mountain fevers is immediate change of climate. Malarial neuroses are common. Supra-orbital neuralgia is very often met with. Intercostal neuralgia is not infrequent. Sciatica, undoubtedly malarial, is sometimes observed.

Dr. McFarland, of Compton, reports a very interesting case of paralysis, malarial in origin, complicated with hysteria. Malarial hæmaturia has also been observed. Miasmatic poisoning produces many remarkable disorders of the nervous system, and here, at least, not a few of these primary malarial neuroses run into typho-malarial fever, if not controlled by anti-periodic treatment. The majority of informants do not believe in the accepted notion that hepatic diseases are common here. It is denied that hepatic abscess, "bilious fever," and other liver troubles are more frequent here than elsewhere. Miasmatic pneumonia, although little studied, little understood, and not often recognized, is nevertheless met with here. The cases reported are unquestionable, and do not differ much from similar cases that occur in Kentucky and South Carolina, and probably in some of the other States.

But this question of malaria has a direct significance to all interested in climatology, more especially here, because Southern California stands in reputation elsewhere second to none as a health resort. For, let malaria be assumed to exist in any neighborhood, and its influence on consumption becomes a question of vital importance. The toxic effects of malarial fever are more apparent on the consumptive—a class of cases peculiarly susceptible to miasmatic poisoning—for, to the already depraved condition of the blood due to the lung disease, there is added an insidious degeneration of the vital forces, produced by malaria. How common is the experience of the practitioner in California, with patients who come from malarial districts in the South or the West, hoping to receive rejuvenation in our climate; yet the benefit derived is too

often counterbalanced by the morbific influences of miasm. The hectic of consumption and the fever of malaria form a terrible combination. Indeed, the relationship between malarial fever and consumption is a subject worthy of extended investigation; and further researches cannot fail finally to pierce the misty veil that obscures the etiology of these diseases.

There has prevailed to some extent a disease that has characters in common with the cerebro-meningitis of Trousseau. It has been called "miasmatic brain fever" by some of the practitioners here. Probably "cerebral fever" is the most expressive term. During the months of June and July, 1878, it was met with not infrequently, and usually proving fatal. The disease, in its approach, is insidious and slow. In the beginning there is generally noticed a chill, or a cold stage, followed by fever. This may be repeated daily, until constant fever, headache, restlessness, vomiting, and great prostration confines the patient in bed. On the fourth or fifth day the more violent symptoms subside, and the patient sinks into a somnolent condition. The pupils are as a rule dilated; there may or may not be photophobia; the skin, especially of the head, is hot and dry; the vomiting is often intractable and constipation obstinate; the abdomen at first is swollen, but later on is retracted (excavated); the urine is copious, limpid, and contains an excess of the phosphates; the heart is weakened, and the pulse moderately quick and full, and the temperature is rarely high, except before death. A highly interesting symptom is noted in some cases, bearing on the question of prognosis. A day or two days preceding death the child may appear to suddenly improve. There is every evidence that recovery will ensue. But the thermometer shows a frightful increase of temperature, such as is incompatible with life if continued. Moreover, this "lightening before death" is soon followed by collapse, and the patient becomes comatose. The respiration in some cases resembles in every particular "Cheyne-Stokes breathing." The *tache cerebrale* has not been observed. Nor have petechiæ been seen in any cases. The treatment seems to be a matter of judgment, guided by special indications. But quinine, bromide of potassium, aconite or digitalis, iodide of potash, ergot, and cathartics form the basis of any medication. Cold applications to the head and counter-irritants are also indicated. One case is reported in which salycylic acid was tried unsuccessfully.

As regards anatomical lesions nothing definite is known, as it seems impossible to obtain autopsies. Some practitioners would look on the disease as essentially malarial in origin; others, as a true meningitis; while some claim that there is a special poison which, coöperating with auxillary causes and referred to the brain, produces this characteristic set of symptoms. Following Boudin, the disease could be called cerebro-typhus. The disease, having to some extent been prevalent during certain months, would be evidence that the cause lay in some special poison. It may be added that the fatality from zymotic diseases among the natives is enormously greater than the same among the imported population. Many causes could be adduced to explain this fact. But in every town there is this native element. Their particular part of the town is acknowledged as unhealthy and frequently the starting point of infectious disease. The crowded condition of their apartments, defective drainage, their ignorance of, and their disregard for, all sanitary laws, and their unexampled debauched habits, render them easy victims to specific or paludal poisons. This would be an unquestionable factor to be considered in statistical tables.

Cases of typho-malarial and pneumatic fevers are usually immured in the darkest corners of adobe houses, and it is no wonder that with the other unfavorable surroundings the mortality is so frightful. Indeed, excluding the native element and the importations of consumptives who come here to die, the death percentage of Southern California will compare favorably with any other State.

July.	Pulsations.	Respirations.	July.	Pulsations.	Respirations.	July.	Pulsations.	Respirations.
4	80	20	8	160	50	12	170	60
5	100	28	9	120	36	13	200	76
6	120	30	10	130	38	14	220	10
7	140	42	11	128	30			

Dora Millar, æt. three years. "Cerebral fever."

EIGHTEEN HUNDRED AND SEVENTY-EIGHT.

In 1878 the total mortality by remittent and intermittent fevers is given as 53, of which 23 were in the Sacramento and San Joaquin Valleys—less than one-half—although, according to the reports of "Prevalent Diseases," the ratio of cases of periodical fever occurring in these valleys as compared with all other portions of the State is very much greater. The fact is another corroboration of the statement often made as to the mildness of the malarial fevers of the valleys of California. Probably not more than two-thirds of the

cases occurring in the localities from which the reports of sickness are received ever find their way into the returns, many of those who suffer being in the habit of treating themselves.

Typhoid fever, according to the reports, is responsible for 205 deaths in 1878, or about 1 in 32 of the total mortality by all causes.

DIPHTHERIA.

The total deaths by diphtheria in 1877 were 1,163, of which 369 occurred outside of San Francisco. Regarding the mortality of the entire State—all of the localities from which reports have been received—we find that 15 per cent. died of diphtheria, or 1 in 6.4. Of the entire number there occurred in January 170, in February 156, in March 136, in April 105, in May 80, in June 75, in July 62, in August 68, in September 64, in October 76, in November 91, in December 80; or, in what is commonly regarded as the rainy season, November to April inclusive, 737, and in the dry season 426; an excess, in the first period, of 311. Were the reports from each of the localities named in the "table" complete, embracing each month in the year, we might draw some important deductions from the relative prevalence of the disease at the two seasons. Some, however, are but partial. Taking those only which are complete or nearly so, 14 in number, not more than two months having been omitted, we obtain the following result: For the rainy season 672, and for the dry season 402, the difference being 270—slightly less than the above. Yet, by an examination of the "table" it may be observed that of the deaths by diphtheria enumerated in the *partial* reports, viz., Dixon, St. Helena, Napa, Bloomfield, Sonoma, Visalia, Modesto, San José, Red Bluff, and Davisville, 23 were in the *dry* season and 65 in the *wet*, the difference being 42.

Again, separating the reports according to their localities—that is, into the four prominent regions, mountains, coast, coast valleys, and interior valleys—we are able to obtain some information, imperfect though it be, as to the presence of the disease in the different parts of the State.

Such a division of the State very much facilitates a review of its sanitary condition; and not only so, but expresses to some extent in tangible characters the influence promotive of disease prevailing in each. In any review of the kind it is much to be regretted, however, that the number of localities from which the reports are received, especially in the mountains, are not more numerous. Only those localities are included from which nearly regular reports have been obtained; coast or near the coast, 6 localities (including San Francisco), 888 deaths; coast valleys, 5 localities, 111; interior central valleys, 5 localities, 49; mountains, 1 locality—the only one from which diphtheria was reported—26. Omitting the large city of San Francisco from the first of these divisions, the result would stand 99. The statistics, then, of diphtheria, as it affected different parts of the State, so far indeed as they are of any value, by reason of the small number of localities reporting, serve to show that the disease was somewhat more prevalent on the coast and in the coast valleys than in the central interior valleys and in the mountains, and that of these the coast valleys presented the greatest number. This predominance is yet more forcibly shown by a comparison of the

deaths by this disease with the population represented by the several localities. Taking the most correct estimate obtainable we find the result to be: On and near the coast (San Francisco excluded), 5 localities, population 16,700, deaths by diphtheria 99; in the coast valleys, 4 localities, population 25,500, deaths by diphtheria 102; interior central valleys, 5 localities, population 48,400, deaths by diphtheria 49; mountains, 3 localities, population 8,400, deaths by diphtheria 26.

SEXES.

Examined according to the sexes, the "table" shows that deaths among males predominated—593 and 535—10 being *unascertained.*

AGES.

The greatest prevalence was among children under 5 years of age—678—an excess of 218 over deaths among all other ages—nearly three-fifths of the total mortality. Between 5 and 10 years there were numbered 375; from 10 to 20 years, 50 cases; while all other ages, known and unknown, furnished only 35. Of the latter, 2 were between 50 and 60, and 1 between 60 and 100.

EIGHTEEN HUNDRED AND SEVENTY-EIGHT.

The record for 1878 exhibits a decided diminution in the mortality by diphtheria. While, in 1877, 24 localities reported 1,163 deaths by this disease, in 1878 we find only 363 deaths in 39 localities; or, if the analysis of the "tables" be confined to towns and cities outside of San Francisco, 351 in the former year and 171 in the latter; and this notwithstanding the much greater regularity of the reports. Selecting from the table for 1878 only those localities from which reports have been regularly received for six months or more, 27 in number, and arranging them according to their geographical positions, and omitting San Francisco, it is observed that in the interior central valley towns, 7 in number, there were 66 deaths; in the coast valleys, 8 in number, 58 deaths; in the coast cities, 5 in number, 26 deaths; in the mountains, 4 in number, 10 deaths; giving predominance to the interior valleys over the coast region, as seemed to be the legitimate deduction from the analysis of the record for 1877.

The following table will exhibit the total mortality by this disease in all localities reported:

TABLE

Of Deaths by Diphtheria, with Sexes, Ages, and Nativities—1877.

CITIES AND TOWNS.	Total deaths.	SEXES.			AGES.									NATIVITIES.			
		Male.	Female.	Unascertained.	Under 5 years.	5 to 10 years.	10 to 20 years.	20 to 30 years.	30 to 40 years.	40 to 50 years.	50 to 60 years.	60 to 100 years.	Unascertained.	Pacific Coast.	Atlantic States.	Foreign Countries.	Unascertained.
San Francisco	794	424	370	...	488	253	32	15	2	2	1	1	...	691	71	32	...
Sacramento	36	23	13	...	21	13	2	...	...	...	...	...	...	33	3	...	...
Stockton	13	7	6	...	6	5	...	...	...	2	...	...	...	10	1	2	...
Petaluma	22	...	...	22	...	...	...	...	...	...	...	...	22	...	...	...	22
Dixon	3	3	...	...	3	...	...	...	...	...	...	...	...	...	3	...	...
Placerville	26	12	14	...	12	13	...	...	...	...	...	...	1	23	3	...	...
Los Angeles	50	25	25	...	33	13	3	1	...	...	...	...	...	37	2	2	9
St. Helena and vicinity	8	2	6	...	6	2	...	...	...	...	...	...	...	6	2	...	...
Napa City	3	...	3	...	1	2	...	...	...	...	...	...	...	3	...	...	...
Watsonville	12	6	5	1	8	4	...	...	...	...	...	...	...	12	...	...	...
Folsom	4	1	3	...	1	3	...	...	...	...	...	...	...	4	...	...	...
Santa Cruz	35	20	15	...	13	20	2	...	...	...	...	...	...	31	3	1	...
Santa Barbara	20	10	10	...	12	6	1	...	...	...	1	...	...	17	3	...	...
Antioch	5	2	3	...	2	2	1	...	...	...	...	...	...	5	...	...	...
Cloverdale	19	7	12	...	7	5	...	...	...	...	...	...	7	19	...	...	...
Sonoma and vicinity	3	1	...	2	...	1	1	...	...	...	...	...	1	1	...	1	1
Bloomfield and vicinity	6	...	3	3	5	...	1	...	...	...	...	...	...	6	...	...	...
San José	30	13	17	...	18	8	4	...	...	...	...	...	...	28	2	...	...
Red Bluff, Tehama County	14	8	6	...	4	5	5	...	...	...	...	...	...	12	2	...	...
Ventura	27	14	13	...	11	8	8	...	...	...	...	...	...	26	...	1	...
Davisville and vicinity	1	...	1	...	1	...	...	...	...	...	...	...	...	1	...	...	...
San Mateo County	11	4	5	2	6	5	...	...	...	...	...	...	...	6	5	...	...
Visalia and vicinity	2	...	...	2	1	1	...	...	...	...	...	...	...	2	...	...	...
Modesto	19	8	11	...	10	8	1	...	...	...	...	...	...	17	2	...	...
Totals	1,163	591	540	32	669	377	61	16	2	4	2	1	31	990	102	39	32

TABLE

Of Deaths by Diphtheria, with Sexes, Ages, and Nativities—1878.

CITIES AND TOWNS.	Total deaths.	SEXES.			AGES.								NATIVITIES.			
		Males.	Females.	Unascertained.	Under 5 years.	5 to 10 years.	10 to 20 years.	20 to 30 years.	30 to 40 years.	40 to 50 years.	50 to 60 years.	60 to 100 years.	Unascertained.	Pacific Coast.	Atlantic States.	Foreign countries.	Unascertained.
San Francisco	192	100	92	----	116	67	8	----	----	----	----	1	----	161	24	7	----
Sacramento	24	10	14	----	13	9	2	----	----	----	----	----	----	21	1	2	----
Stockton	9	6	3	----	4	4	1	----	----	----	----	----	----	8	1	----	----
Petaluma	2	----	----	2	----	----	----	----	----	----	----	----	2	1	----	----	1
Marysville	8	2	6	----	4	4	----	----	----	----	----	----	----	7	1	----	----
Placerville	2	1	1	----	1	1	----	----	----	----	----	----	----	2	----	----	----
Los Angeles	23	12	11	----	10	13	----	----	----	----	----	----	----	20	3	----	----
St. Helena and vicinity	5	----	5	----	3	1	1	----	----	----	----	----	----	3	2	----	----
Folsom	1	1	----	----	----	1	----	----	----	----	----	----	----	1	----	----	----
Santa Cruz	7	5	2	----	5	1	----	1	----	----	----	----	----	5	2	----	----
Willows	2	2	----	----	2	----	----	----	----	----	----	----	----	2	----	----	----
Santa Barbara	4	1	3	----	2	2	----	----	----	----	----	----	----	4	----	----	----
Downieville and vicinity	1	1	----	----	1	----	----	----	----	----	----	----	----	1	----	----	----
Antioch	1	----	1	----	----	1	----	----	----	----	----	----	----	1	----	----	----
Cloverdale	2	----	2	----	2	----	----	----	----	----	----	----	----	2	----	----	----
Sonoma and vicinity	1	1	----	----	1	----	----	----	----	----	----	----	----	----	----	----	1
Cedarville, Modoc County	4	----	4	----	1	2	1	----	----	----	----	----	----	4	----	----	----
Santa Rosa	3	1	2	----	2	1	----	----	----	----	----	----	----	3	----	----	----
San José	2	1	1	----	2	----	----	----	----	----	----	----	----	2	----	----	----
Vallejo	1	1	----	----	----	1	----	----	----	----	----	----	----	1	----	----	----
Shasta	2	1	1	----	1	1	----	----	----	----	----	----	----	2	----	----	----
Red Bluff, Tehama County	2	----	2	----	----	1	1	----	----	----	----	----	----	1	1	----	----
Lakeport	3	----	----	3	----	----	----	----	----	----	----	----	3	----	----	----	3
Ventura	15	7	8	----	4	7	4	----	----	----	----	----	----	15	----	----	----
Chico	20	10	10	----	10	7	3	----	----	----	----	----	----	6	2	----	12
San Mateo County	4	4	----	----	2	2	----	----	----	----	----	----	----	4	----	----	----
San Diego	1	----	1	----	----	1	----	----	----	----	----	----	----	----	1	----	----
Tulare County	21	----	----	21	----	----	----	----	----	----	----	----	21	----	----	----	21
San Luis Obispo	1	1	----	----	1	----	----	----	----	----	----	----	----	----	----	1	----
Totals	363	168	169	26	187	127	21	1	----	----	----	1	26	277	38	10	38

The prevalence of diphtheria during the year under review (1878) may, however, be more intelligently understood by the reports of "Prevalent Diseases," which many of the correspondents of the State Board have kindly furnished on "postal card" blanks. The diseases specified on the cards being such only as are commonly regarded as belonging to the zymotic class, or diseases, which, under strict sanitary discipline, are considered to be more or less preventable, they have been found, in practice, to be convenient, and, in the results obtained, entirely satisfactory. It has been objected to these reports that they are likely to be unreliable on account of errors in diagnosis. Such errors may possibly occur. They are incidental to all general medical statistical reports; they especially affect the vital statistics of every city and State where such statistics are registered; they arise from the imperfection of the human judgment. To this extent, doubtless, the reports received at the office of the State Board of Health are defective, no farther. They are made by gentlemen of whom it is believed that each one is fully competent for the work, and by whom it is gratuitously performed at no little sacrifice of time.

Assuming then an equal degree of reliability for these reports with those elsewhere, a chart has been prepared showing the extent to which a few of the more prevalent diseases occurred, and arranged

in such a manner as to exhibit their relative prevalence in different sections of the State. They embrace 19 localities, from which reports have been received with sufficient regularity to justify their representation on the chart, viz., 5 from the interior central valleys; 4 from the coast, or near the coast; 4 from the mountains, and 6 from the coast valleys. The percentage for diphtheria is represented by the dotted line (No. 4), and with it croup is included, inasmuch as the membranous variety of the latter was specified, and as it was observed to occur during the prevalence of diphtheria so uniformly as to leave little room for doubt as to the identity of the two diseases.

Briefly commenting on the chart, we find diphtheria to have prevailed most on the coast, next in the coast valleys, next in the central valleys, and least in the mountains. The sum of the percentages for each of these sections for the year being, in the order above mentioned, 160, 124, 90, 66 (December omitted from the last). The inequality of the number of localities reporting from each of these divisions does not materially change the result. The monthly prevalence of the malady is shown by percentages to be greatest in January, 64, February, 60, March, 47, and December, 65; or, by seasons, greater during the rainy season than during the dry. The lowest percentage of any one month was 16, in September; next 19, in August; next 21, in April.

For the purpose of arriving at the most reliable conclusions as to some of the more important features of the disease under consideration, more especially its causation, a circular letter was addressed to the correspondents of the Board, and to some other qualified medical gentlemen in the State, soliciting answers to the following questions:

1. Has diphtheria prevailed to any extent in your locality or its vicinity during the year just ending?
2. Has there been an increase or diminution in its prevalence as compared with the previous year?
3. During what months has it most prevailed? (Please state, if possible, the period of its *first* and *last* appearance during the year.)
4. Have you been able to trace the disease to any special local causes, such as dampness of locality, defective drainage, imperfect sewerage, impure water, or other insanitary conditions?
5. Has there been any marked difference in its prevalence during the *dry* and *rainy* seasons?
6. Has it been, according to your observation, contagious? Please state any facts, coming within your notice, bearing upon the question of its causation.

To these questions replies have been received from twenty-four physicians resident in different parts of the State.

Dr. W. C. Baylor, Willows, Colusa County:

No. 1—Cases fourteen, within a radius of fifteen miles.
No. 2—There has been an increase.
No. 3—In September, 1878, closing with December 31st, 1878.
No. 4—All the cases occurring in this vicinity have been on the plains or in the foothills—only one case in town. I could discern no local cause sufficient, in my judgment, to produce any disease.
No. 5—All the cases coming under my observation have been during the *dry* season. (The fall of 1878 was remarkably dry, there having been but little rain until after the middle of January, 1879, and the dry north wind prevailing.)
No. 6—In none of the families had there been any exposure for the first cases that occurred. After this other members of the same families were attacked. One case took the disease after being in contact with children who had recovered and had been going around for a month. I do not think the child contracted the disease by this association.

Dr. W. T. Bell, Winters, Yolo County:

No. 1—There has been but one case, introduced from Knight's Landing, but by using great precautions it did not spread.
No. 3—The above case occurred in August last.
No. 6—It undoubtedly is. A San Francisco family lost one child in that city in 1877—removed here with two children who were ill with the disease, attacked one month after the death of the first. Another family visited the centennial exposition. One child contracted the disease in Pennsylvania—returned, and five children of the same family were taken sick with it, proving fatal in one.

Dr. G. W. Westlake, Red Bluff, writes the following:

In reply to questions regarding diphtheria, I take pleasure in communicating the followin- information: The first case that ever occurred in this locality was in October, 1877. F that time it assumed an epidemic form, and lasted until March, 1878. Only four case

occurred in the town since that time, and those during the month of September. There were, I think, fifty well-marked cases from October, 1877, to March, 1878, besides numerous cases of diphtheritic sore throat, without much constitutional involvement. Of the fifty cases, sixteen proved fatal. The ages of those attacked were from three to seventeen years; sexes about equal. About one-half the fatal cases were of the nasal and laryngeal forms. The disease seemed to originate here, and we could give no good reason for its origin. It attacked families almost simultaneously in the western, eastern, and southern portions of the town. It had no respect for condition in life. (The colored population suffered more than the white in the number of deaths.) The sanitary condition of the town was equally as good as in former years. We could not trace its origin to any local cause whatever. I have no positive proof of its contagiousness.

Dr. A. B. Caldwell, Marysville:

No. 1—It has prevailed to an extent, during the nine weeks past, unknown previously.

No. 2—There was no really authentic case during the year 1877, within the city limits, though several were so reported in the vicinity of the town.

No. 3—The disease prevailed to its greatest extent between the latter part of October and the middle of December, 1878. After careful inquiry, I find the earliest authentic cases to have occurred about the 17th of October, and the last genuine case about the 28th of December, 1878. During the early months of last spring there was one case reported, but, to my belief, incorrectly.

No. 4—There seems to be no special local cause, though I believe, with one exception, the disease appeared only in such portions of our city as were not supplied with the city water, but from ordinary wells of an average depth of fourteen to eighteen feet, and situated in localities which, from their lowness and their proximity to privies of greater or less depth, were poorly adapted to supply water for drinking purposes. In all, save one case referred to above, the sanitary conditions were imperfect. These remarks apply only to the cases originating within the city limits. There were cases brought from one locality, sixteen miles from town, at various stages of the disease, and all proving fatal. * * * I feel almost positive that within the city limits there were not more than thirteen genuine cases, of which eight were fatal, including those from sixteen miles away. Of course there was the usual number of so-called cases of diphtheria. Being cognizant of the surroundings (at home) of the cases brought to town for treatment I am sure sanitary neglect might have had its bad influence.

No. 5—During the prevalence of the disease the weather was, of course, much the same as in your city. Moisture could have been no predisposing cause; indeed, there was a decided falling off as soon as the December rains came.

No. 6—The first two cases occurred simultaneously in one household, and were immediately fatal. Four days after the termination of these two fatal cases the third and only remaining child was attacked, with a like result, in a very few days. Other children in the neighborhood were not attacked, although none were immediately exposed to contagion. The next lot of cases occurred in a remote portion of the town, and, of four in one small neighborhood, two were, within ten days, fatal. The other cases, fatal and otherwise, did not seem to follow at a time or in a manner to suggest contagion to be much dreaded. In fact, there seems to me to be strong evidence in the cases under my own observation against the theory of contagion in the ordinary acceptation.

Dr. G. W. Davis, Chico:

No. 1—Yes, it has prevailed to a considerable extent.

No. 2—There has been an increase.

No. 3—During the months of March, April, and May. Its first appearance was in October, 1877, and it still prevails to a small extent.

No. 4—Yes; dampness of locality and defective drainage, and, in several instances, impure water.

No. 5—Yes; has been prevalent during the rainy season.

No. 6—I answer, emphatically, no.

To enlarge more upon the question of the causation of diphtheria: Allow me to say that in every instance in Chico and vicinity the cause has been traced to dampness of locality. In the Town of Chico most of the residences are densely shaded, and, with few exceptions, have been built low upon the ground. Last winter was one in which an unusual amount of rain fell, and withal most of the time it was warm and pleasant, so much so that vegetation sprang into new life quite early, and by the middle of April the tree foliage was dense. This prevented the warm rays of the sun from penetrating and relieving the saturated soil of its superabundance of water, as well as drying the porches and entrances to those houses that were thus so densely shaded by trees and running vines. During the summer there was a remarkable absence of north winds; this with the rains, early and late, the heavy foliage, and many of the houses being low upon the ground, was the true cause of much fatal diphtheria in the month of May. [illegible] fatal cases occurred throughout the entire summer. The cause of cases upon [illegible]d to attend in the country was directly traceable to overflown cellars, or, as in [illegible] water had seeped into them. For nearly two months the cold dry north [illegible], during which time diphtheria has very rapidly diminished. At [illegible] cases.

Dr. W. R. Fox, San Bernardino:

No. 1—No.
No. 2—A rare disease here as yet. Some doctors see it in every case of sore throat.
No. 4—No.
No. 5—No.
No. 6—No, not in the ordinary acceptation of the term.

Dr. K. D. Shugart, Riverside, San Bernardino County:

No. 1—No.
No. 2—No.
No. 3—We have not had any.
No. 6—I do not believe diphtheria to be contagious as a rule. Pseudo-membranous croup and diphtheria I look upon as distinct diseases. I have seen but one case of diphtheria and three cases of pseudo-membranous croup since I have been here—a little over eight years. The croup occurred during damp weather.

Dr. C. A. Kirkpatrick, Redwood City:

No. 1—It has prevailed extensively at Mayfield, seven miles from Redwood City; to a less extent at Menlo Park, four miles distant; but to a very limited extent in Redwood City, or nearer thereto than Menlo Park.
No. 2—There has been an increase during the last year over any previous year for fourteen years. During January, February, and March, 1875, it prevailed to a slight extent, but disappeared until near January, 1878.
No. 3—There were a few cases in December, 1877, and in January, February, and March, 1878; then it decreased until November and December, when it now seems as if it had departed with the old year, as I do not know of a case either in Mayfield or vicinity or in San Mateo County.
No. 4—I have not. The locality of Mayfield precludes the idea of dampness or sewerage. The water supply is from wells, but remains constantly the same, and there seems to be no good reason why the disease should prevail there.
No. 5—So far as it is possible to ascertain, the disease was as virulent and fatal during November and December as it was in January and February, when the Town of Mayfield was flooded.
No. 6—It has not.

Dr. H. C. Crowder, Bloomfield, Sonoma County:

No. 1—No.
No. 2—Less.
No. 3—Through the winter months; very few cases in 1878, and these in January and February.
No. 4—I have not.
No. 5—Yes; during the rainy season it was worse.
No. 6—I am compelled to think it is not contagious.

Dr. G. M. Wells, Sonoma, Sonoma County:

No. 1—No; my reports cover three cases in one family, with one death.
No. 2—Probably a slight increase.
No. 3—The cases reported occurred in June.
No. 4—No; my observation has been too restricted. In Petaluma, where it has been so fatal, heavy fogs and damp cold winds were undoubtedly causative.
No. 6—It seemed to be sporadic in the cases reported.

Dr. B. S. Young, Santa Rosa:

No. 1—The first three months of the year—not since.
No. 2—Diminution.
No. 3—January, February, and March. It first appeared in January; abated during the summer months to reappear in September; since then we have had none.
No. 5—Prevails mostly in rainy or damp weather.
No. 6—In many instances it can be traced to contagion or infection. I believe it contagious.

Parties occupying houses where previous occupant had the disease, although the premises were fumigated, have contracted it—not in one family in such premises, but in three or four to the house, one after another.

Dr. Q. C. Smith, Cloverdale, Sonoma County:

No. 1—Only a few cases.
No. 2—Diminution.
No. 3—During winter months.
No. 4—No; it has prevailed in wet and very dry weather and places; in our village and the remote mountain localities.
No. 5—No; but most, or all, were in cool or cold weather; none in hot weather.
No. 6—We do not believe it to be contagious in the ordinary sense of the term, but we always give the children the benefit of the *doubt*. It is contagious in the strict sense of the word, however, but not infectious.

Recurring to Nos. 4 and 6, Dr. Smith adds:

No. 4—We have closely watched for some local cause for diphtheria, but have been unable to assign any cause that a larger experience did not prove a fallacy. Our cases were mostly, if not entirely, in cool or cold weather; but some were in wet and some in very dry weather. Our recent epidemic began and ended in one of the dryest times I have seen here in a period of five years. Diphtheria has raged more virulently in our sparsely-settled mountain districts, where everything *seemed* conducive to health, than in our village; for it has never raged extensively here in Cloverdale, from two to twelve cases being the extent of an epidemic.

No. 6—We have accumulated all the oral and written information of others, and closely observed the disease in its various aspects, but have not been able to come to any *definite* conclusion, either as to its *cause* or *contagiousness*. Surely, not foul air, nor dry nor wet air, has had *any* influence in its causation; and *often* we have seen cases arise far out in the mountains, in the most secluded, clean, salubrious localities, *to all appearances de novo;* and frequently one, and in some cases two children, out of five or six, have the disease, and die or recover, and the other children live and closely associate with the sick ones and yet remain well; for, in some cases, there was but one room in the house, and all must stay in it.

Dr. W. W. Hays, San Luis Obispo:

No. 1—Some scattered cases this fall just past.
No. 2—Diminution.
No. 3—During the fall and winter. I hear that diphtheria was seen in the interior of the county last summer.
No. 4—No; there has been no preference shown for unhealthy localities.
No. 5—Yes; it is more prevalent during the *rainy* season, or rather during the fall or winter months. It commenced last year *before* the rains, when the nights grew cold, and the daily changes of temperature were great.
No. 6—The epidemic which occurred in this town a year ago was directly traced to contagion. A lady from Santa Maria, Santa Barbara County, where the disease had been very fatal, having lost two children, in passing through the town spent one night at the house of a friend. The disease commenced in that house. The three children were attacked, and one died. The next case I saw was in an adjoining house, and thence it spread all over the town; some of the most unhealthy localities, however, escaping, while others, whose surroundings were perfect in a sanitary point of view, were visited in a severe form. The mild epidemic which now prevails here can also be directly traced to contagion. It originated (in the practice of another physician) outside of town, in a Spanish family, who had stopping with them a friend from Guadalupe, Santa Barbara County, where the disease was then prevalent. One child died. The neighbors from an adjoining house assisted in nursing; their children took the disease, and three died. From thence it spread to the town. I saw over two hundred cases last year, and in every one there was direct evidence of contagion. Although I believe contagion to have been the cause of the spread of the disease in this locality during the last two years, it is also true that in low situations the symptoms were of a more intense character than in more favorable localities. I do not think that this severity was so much caused by the dampness (for in both epidemics the disease was most fatal before the rains) as by the lower temperature which occurs at night in low-lying situations. * * * * * * * * * * * * *

Dr. C. L. Anderson, Santa Cruz:

No. 1—Yes; several cases.
No. 2—There has been a slight decrease, perhaps.
No. 3—July and November. All cases have been sporadic, and nearly every month cases have occurred, but usually in a mild form.

No. 4—No special local causes have been discovered the past year. Some peculiar susceptibility of temperament has been noticed in most cases.

No. 5—I think not. Humidity has had but little influence as far as I have observed. Some of the worst cases have occurred at both seasons, although, on the coast here, there is usually more humidity in the *dry* season than in the *rainy*, owing to the fog.

No. 6—Yes; it seems to be contagious. Nurses, attendants, and every one coming in contact with those diseased with diphtheria have suffered, more or less, with its specific symptoms. So far as I can remember I have not known persons to have diphtheria a second time. I have heard of frequent repetitions of the disease, but am satisfied the repetitions were not diphtheria. A second attack may occur, just as in varioloid or scarlatina, but these attacks are exceptions. There is also a family susceptibility to the disease. Brothers, sisters, and cousins, with or without the slightest contact, have suffered, even when miles apart, and only some member of the family have visited the sick, and have apparently *carried* the disease from one to another. As in all contagious diseases many are entirely exempt, and never contract the disease, however close or continuous the contact. This fact is not less plainly true in regard to diphtheria.

In regard to causation, my observations warrant me in believing that there is a specific principle or germ which is propagated and diffused under favorable conditions, yet hidden to us, and which produces what we call diphtheria. More likely it is fungoid in its character, and analagous to certain "blights" that attack vegetation. * * * * * * *

Dr. F. Delmont, San Buenaventura:

No. 1—Yes, to a great extent.

No. 2—An increase.

No. 3—January and February, and still more in July and December.

No. 4—Yes; to dampness, defective drainage, sewerage, and, to a great extent, to impure water. Diphtheria has been more prevalent, in this county, on low irrigated lands, on the banks of the Santa Clara River, and in places where bad drainage exists.

No. 5—No.

No. 6—Yes; e. g., persons drinking from the same cup or glass used by the sick, or using the same spoon or towel, have invariably contracted the disease.

Dr. W. C. Jones, Grass Valley:

No. 1—A few sporadic cases in January, and again in December.

No. 2—About the same.

No. 3—January and December. We now have a case, January 10th, 1879.

No. 4—No.

No. 5—The cases here, in 1878 and so far in 1879, were during the time of *dry, cold, north* winds.

No. 6—Yes; four cases in one family during one month, each separately. Attended three cases in December, croupal in form, two of them in one family, caused apparantly by cold north wind; one died after trocheotomy.

Dr. J. M. Briceland, Shasta:

No. 1—It has not.

No. 2—In 1878 diphtheria first appeared in Shasta and vicinity; *five* cases; three made good recoveries, but two died. Both the latter were in the same family—very malignant. There was no further spread of the disease.

No. 3—About the 15th of August to September 1st, 1878.

No. 4—Strict inquiry failed to develop any insanitary condition.

No. 5—All cases during *dry* season.

No. 6—In the family in which the two deaths occurred, the disease was not communicated to other members, nor to any of the many visitors to the sick-room, although both cases were of a malignant type. I do not believe it is contagious. In Birney Valley, distant sixty miles from Shasta, during the months of July and August (dry season) several cases were reported. The fatality seemed to be confined to families on water courses—Hatchet Creek, Cow Creek, etc. The cause was undoubtedly local, the cases being confined to a few families. Since September, no cases reported.

From Sacramento, Dr. G. L. Simmons gives the following answers:

No. 1—Yes.

No. 2—Diminution.

No. 3—First occurred in August. Sporadic cases occurred until January.

No. 4—No.

No. 5—I think my worst cases have occurred in the dry season.

No. 6—I inclose a diagram intended to represent, approximatively at least, the localities of an epidemic of diphtheria which prevailed during the past season. The majority of the infected premises are in a district of acknowledged salubrity—higher than the surrounding country, supplied with good water, and with well drained soil. The form of the disease, according to the statements of attendants, was of a malignant type, and of the thirty-three cases which occurred, eight terminated fatally.

According to my observation in this district, as in others, I believe the disease to be highly contagious. At the commencement of the epidemic children out of infected families were regularly sent to the public schools (shown in the diagram), and all who suffered were more or less exposed to the contagion. In one of the cases where there was no school attendance, the patient had watched with a child dying of diphtheria. In another instance, a diphtheritic case from this locality was removed to the bank of the Sacramento River, in Yolo County, several miles away, and became the center of another epidemic which desolated several homes.

Whether the insanitary conditions which surround the hide-curing establishments, glue factories, and slaughter houses (exhibited in the diagram) had aught to do with the causation of this epidemic, I believe to be a question open for further investigation. It is certain, however, that the persons employed in these places escaped without an attack, while those in the neighborhood, under supposed healthier conditions, fell victims to the malady.

Dr. Alemby Jump, Downieville:

No. 1—At Goodyear's Bar, on the Yuba River. Seven cases in December; four in one family, two in one, and one in another. The disease made its appearance on the 18th of December—five cases in three families on that day. Three days afterward two cases appeared in two of the families before referred to.

No. 2—No particular change in this respect. It strikes, then disappears for years, then strikes again. In November, 1867, a family of seven was stricken at Goodyear's Bar; four cases occurred, and three died. There has been no diphtheria on that bar from that time until last December.

No. 3—Late in the fall or early winter. It commenced December 18th, and continued to the end of the year. In 1867 it commenced on the 15th of November—two cases; four days afterward *one;* and in six days the fourth case, which recovered.

No. 4—Imperfect sewerage might be a cause. The weather had been extremely dry, and continued so until the end of the year. There was less water than had ever been observed before.

No. 5—Diphtheria seems to prevail at the end of a long dry season, when fall runs into winter. Dry cold weather seems to be productive of the diphtheritic influence.

No. 6—Yes. In my late cases all the children in each family were sick, except one. In 1867, in a family at Goodyear's Bar of seven children, two were past recovery when called, and died the next day; a third was taken the following day, and was treated eleven days and died; while he was under treatment a fourth was taken sick, and I had a fine exhibition of what Slade called the punched tonsil. It recovered. At my suggestion the well children were removed from the family residence; but upon losing the first two the mother had the children brought home, but kept the *well* away from the *sick*. The greatest cause of diphtheria in the mountains, in my opinion, is the proximity of privies to residences; especially is this the case in the higher mountains, where the snow falls the deepest.

Dr. Geo. S. Farley, North San Juan:

No. 1—Yes; 1878.

No. 2—Diminution. In the two years previous it prevailed as a terrible epidemic.

No. 3—It chose no particular month, and its last appearance was in October.

No. 4—No; for it appears to have attacked the cleanly as well as the filthy families, the dry as well as the damp localities, and it had no respect for person or place.

No. 5—No; no change of weather made any difference.

No. 6—Yes; especially when persons have been indiscreet enough to neglect ventilation, or to lie upon the bed with, or kiss the affected person. It was distributed by persons in whose families the disease had been, either by a change of locality or by sending children to school within six weeks. Where the person changed locality, at that locality within ten days the disease would start; and where children were sent to school, those sitting next to them would be the ones first attacked by the disease; apparently the more healthy the locality the more virulent the disease.

After the epidemic that had prevailed here on this ridge for two years and more had ceased, one case, apparently *sui generis*, attacked one of the healthiest localities upon the ridge. It had been specially cared for and kept away from any contagion. * * * * *

Dr. W. H. Patterson, Cedarville, Modoc County:

Previous to November, 1877, diphtheria was unknown in Modoc County. Its first appearance was at Alturas, the county seat, at the time mentioned. It prevailed during four months in that village and vicinity, claiming one or more victims in nearly every family. At one time those who were well were hardly enough to care for the sick. In March it disappeared, to return in one family the following June. In Alturas the total number of deaths was twenty-three (23), I think. Of these none were adults, and but two males. In April, 1878, it attacked fifteen persons in Surprise Valley, of whom none died.

As to the origin of the disease, I cannot but think that the poison to which it was due emanated from a large body of swamp land lying to the windward of the affected district. The winter of 1877–78 was an unusually open one here. Premising this and the further remarks that our winds come almost constantly from the southwest, and that the affected district lay to the northeast of the large swamp referred to, a reasonable cause for suspecting this origin of the disease will be seen. As the epidemic advanced and it was observed that those living nearest the swamp were the most severely affected, and that not a single case occurred to the windward thereof, the suspicion became almost a certainty. This was still further strengthened by the outbreak in Surprise Valley, which lies to the east of Pitt River Valley, in which latter is located the swamp spoken of. The two valleys are separated by a high mountain range, with numerous cañons or gaps traversing it from west to east; and through these gaps the wind from the southwest blows with great constancy. No case of diphtheria ever occurred in Surprise Valley, except in persons living near the mouths of the three cañons by which the winds sweeping the Pitt River swamps reach Surprise Valley. Ten cases occurred in one large family at the mouth of the cañon, most directly in the line of this wind. Other families more remote

from the cañon, but in the line of the air current, suffered from sore throat, which may have been mild diphtheria. At the mouth of the second cañon no family of children dwelt, and one case of the disease in an adult appeared. At the Cedarville Pass two families living nearest the cañon, and no others, were affected. The fact that the disease appeared only in families living at the mouths of the cañons seemed to show that the infection came on the winds from the southwest; and the further fact, that of a dozen cañons it was only those three carrying winds from the Pitt River swamps that seemed to be inlets for the poison, would appear almost conclusive proof of the theory already advanced. What, then, was this poison? Did it owe its origin to some peculiarity of the moistened soil; to decaying vegetable matter; to water virtually stagnant, or to a combination of two or more of these conditions? That it was to some of these seems probable, and an isolated instance occurring at Alturas in June renders this more likely. When the winter epidemic had been subdued, perhaps by the spring freshets, an overflow of the town site took place, leaving the cellar under the "Combs House" filled with decaying cabbage, turnips, and potatoes, and stagnant water. Mr. Combs' family had, during winter, at my suggestion, occupied rooms in the upper story of the house; but now that the pestilence had spent its wrath and gone, they unadvisedly took up their abode in rooms on the lower floor and immediately over the cellar. The result was three attacks and two deaths in the family. My experience, as stated, leads me to believe:

First—That the poison to which diphtheria is due may originate from stagnant water and decaying vegetable matter.

Second—That this poison may be carried to considerable distances on the wind.

Third—That in its transference the poison may be diluted.

Fourth—That the violence of the attack varies in part according to the dilution of the poison, and in part according to age, sex, constitution, and previous health of the patient.

Fifth—That in this, as in ague, elevation above the immediate surface of the ground may afford immunity from attack.

I may further add, that Alturas is located on alkali bottom land, near the confluence of the North and South Forks of Pitt River; is without sewers of any kind; has but poor natural drainage; is supplied with water for all purposes from Pitt River and from shallow wells in the alkali soil; that the drinking water is distasteful to strangers, who generally suffer from diarrhœa on their first visit; and that in 1876 the town and neighboring country was visited by a very fatal typho-malarial fever.

The following communication from Dr. Rooney, of Colfax, Placer County, will show the prevalence of diphtheria there:

On the 6th of September, 1878, an epidemic of diphtheria broke out in this place, which has raged intermittingly almost up to the present date; the last case I attended being convalescent on the 7th of the present month. The epidemic began and ended with the rainy season; and my observation always confirmed the fact that after every cold rain storm new cases would break out. Colfax is a small place, containing only about six hundred inhabitants. It supports but one medical man, and consequently I have had an opportunity of seeing nearly all the cases that have occurred, having treated all but a small number, having occasional counsel. I have embodied no cases in this report excepting those that have come under my own observation. The others were mild and doubtful, requiring little treatment. During the period mentioned, there have been sixty-two well marked cases of diphtheria in this place, besides numerous sore throats, which, in the absence of real diphtheria, might be classed as such. This is a very large percentage for the number of inhabitants, and, when the virulence of the epidemic is considered, proves that some great cause of propagation exists. Ten deaths have occurred since the outbreak, three of which were cases that received no medical attention until far advanced, and when little could be done. Ten others recovered only after the most unremitting attention and careful nursing. The youngest child having it was eighteen months old. Four adults were attacked by it, two of whom had it twice within a few weeks. One case, a girl thirteen years of age, had the disease three times within six months—twice severely. The first real case of diphtheria in Colfax occurred some three years ago, previous to my coming to the place, and I cannot give any authentic account of it. It came in conjunction with scarlatina, and caused some five or six deaths at that time. It remained quiescent for about eighteen months, when the present epidemic started. It would appear to superficial observation as though the first case of the present outbreak was caused directly by contagion. A young lady had the disease at Reno, and, three weeks after convalescence, came on here. She stopped three days in the house where the first case appeared, and in about three weeks more the youngest child of the family, where she stopped, was attacked. But, from the fact that the disease had been in the place before, and that such a long period had elapsed after the young lady's convalescence, and also before the child took the disease after possible contagion, and that the house where it occurred stood in a favorable location for miasmatic conditions to influence it, the question becomes more obscure. And furthermore, in no other case could direct contagion be traced. To be sure, several members of the same families were attacked, but that proved nothing, as the same local causes which generated the first case were still in existence to promote the disease in subsequent ones. In my own humble opinion, the epidemic was caused by the bad sewerage of the town. Colfax lies in a little valley between the hills, and in summer there is no drainage whatever. The water supply is pure and good, but insufficient to flush the sewers, and the drainage from the

two large hotels and all the private residences runs in uncovered sewers, and in the summer season dries into the earth. Now, supposing the germs of the disease to be already in existence, the advent of the first autumnal rains, followed by warm days, would convert all this dried up sewerage into a festering mass of corruption and disease. The germs of the disease being once liberated, would multiply themselves in a thousand fold, and the question of thorough saturation of the atmosphere with poisonous germs would be a question of a short time. Then, again, after the epidemic had assumed alarming proportions, I caused a public meeting to be held, at which funds were subscribed and resolutions adopted to thoroughly cleanse the town. This was done, and was followed by an immediate abatement of the disease. Then followed a period of cold weather, and snow lay upon the ground for four weeks. Upon the disappearance of the snow, the disease again began its ravages, and only ceased upon the cessation of the rains. Another factor in the propagation of the disease was the fearful condition of Chinatown. All the filth, corruption, and nameless horrors that the mind can conceive were centered here. The Chinese quarters lie at the north end of the town, and the night wind from the mountains sucks the miasma from the higher to the lower grounds, and our people lay unsuspectingly imbibing these noxious vapors during their hours of sleep, whilst the system is in a state of relaxation, and just right to imbibe and assimilate the poison. Still another factor is the existence of a slaughter house in the midst of the town. The stench from this is abominable, and no doubt tends to increase the life of the disease. The water supply of the town is pure and good, and can have nothing to do with the epidemic. The most of it comes from tunnels, which have been run into the mountain back of the town, and is *almost absolutely pure.* The privies and back premises of all the white citizens are in good condition, and have been ever since the public meeting was held.

Dr. C. B. Bates, Santa Barbara:

No. 1—There have been a few sporadic cases during the entire year.
No. 2—A marked diminution.
No. 3—More during the spring and fall than during the summer.
No. 4—No; cases have occurred in all portions of the town.
No. 5—No.
No. 6—The disease first occurred rather more than two years ago, in a family visited by a child who had contracted it in Los Angeles. Since then I cannot say that I have been able directly to trace any of the cases to contagion, although the probabilities are great that many have occurred in this city.

Dr. W. D. Rodgers, Watsonville:

No. 1—To a limited extent.
No. 2—There was much less the past year.
No. 3—August, September, October, and November.
No. 4—The drainage of our town has been defective, and our water (surface) necessarily impure; but we are now supplied with pure water.
No. 5—It has generally prevailed during the dry season.
No. 6—We believe it to be contagious.

Dr. C. A. Kirkpatrick furnishes the following remarks upon diphtheria, as it prevailed in Mayfield, Santa Clara County:

The history of the outbreak and deadly work of diphtheria at Mayfield and vicinity will give, also, a correct illustration of its invasion into the southern part of San Mateo County.

There had been a few cases reported in the months of October and November, 1877, but not at all approaching the character of an epidemic until about the first of January, 1878. Since that date, the first cases of diphtheria in Mayfield occurred in a family living in a house elevated about eighteen inches above the ground, and that space under the house all open, giving free circulation of air—no pent-up sewers with an occasional opening for the escape of the noxious gases generated therein, for there were no sewers there; and before and at the time of the first appearance of the disease the whole valley was overflowed and washed clean by a flood to the depth of from one to two feet, and which did not leave a debris of decaying vegetable or other organic matter.

Under such circumstances the disease made its first appearance, and during the year, up to the 31st of December, when the changes and conditions were of such various characters, the record of its work stands thus:

January—five cases	2 deaths.	June—three cases	2 deaths.
February—seven cases	4 deaths.	August—eleven cases	5 deaths.
March—four cases	3 deaths.	September—seven cases	2 deaths.
April—three cases	1 death.		

Now, in regard to the locality, soil, water, etc., Mayfield is situated in the northern part of Santa Clara County, and about one mile and a half south of the San Francisquita Creek, which is the

boundary line between Santa Clara and San Mateo Counties. It is about three miles from the bay and less than one mile from the foothills to the west. The soil is of three kinds: First, the heavy, black, pure adobe; second, a mixture of a dark, porous, somewhat gravelly soil; and third, a lighter colored gravelly soil. Of the forty cases, nineteen were in the adobe district, but seven of them were brought there from the country, where they had contracted the disease before coming to town; and out of the nineteen but five died; while of the twenty-one attacked in the porous and gravelly district, fourteen died; thus showing a large balance of mortality as occurring in the porous, gravelly localities.

This coincides with my experience at Menlo Park and Woodside, in San Mateo County, while at Redwood City, which is situated in a pure adobe district, and at an elevation of only about two feet above high tide, we have never had an invasion of the disease that could fairly be called epidemic. The soil at Menlo Park bears a general resemblance to that of Mayfield, but the surroundings are very different, in that Mayfield is on an open plain, while Menlo Park is situated in the midst of a forest of white and live oaks, while Woodside nestles among the hills at the foot of the mountains.

Now, if it be not true that the disease is more likely to occur and be more fatal in localities where the soil is loose and gravelly, how can we account for the above facts?

Now, in regard to the water, the sources of supply are so diverse that I do not attach much, if any, importance to that as giving a clue to the origin or propagation of the disease. I have not seen or known of a case in which there was any conclusive evidence that the water used about the premises had anything to do with its development or progress in the most remote manner whatever. The water in Mayfield is derived from two sources—surface wells, as they are called, sunk to the depth of from fifteen to twenty-five feet, and artesian wells, sunk to the depth of one hundred and fifty feet. At Menlo Park, from surface and artesian wells as above, at Mayfield, and also from the reservoir of the Corte Madera water-works. At Woodside the water is obtained from surface wells and from the pure, sparkling rill, as it flows from the mountain side. At Redwood City the water supply is from surface wells, artesian wells, and from a reservoir filled by a mountain spring.

Now, then, referring back to Mayfield as the basis of this report, and reviewing the locality, water supply, ventilation, sewerage, etc., there is nothing, to my mind, to rationally account for the invasion of the disease on accepted theories.

From the responses of correspondents it will be observed that there exists a great diversity of opinion about some of the most important factors in the causation of diphtheria, as it manifested itself in California during the last two years. The answers to Question No. 4 are particularly noticeable, on account of the small number which recognize any connection between this disease and "dampness of locality, defective drainage, imperfect sewerage, impure water, or other insanitary conditions"—only eight out of a total of twenty-four. In one instance no answer is given to this question, in consequence of the absence of any case of diphtheria in the locality represented.

It is not affirmed by those answering in the negative that, in their judgment, diphtheria *never* sustains an intimate relation to some one or more of the conditions referred to—that dampness of soil, of dwelling, of air, never acts as an exciting or even predisposing cause of the disease; that drainage, however imperfect, sewers, however foul and unventilated, water, however impure, and the other surroundings to which the term "insanitary" may be properly applied, are never found so intimately associated with it as to be considered in some manner causative, but that, in the instances coming under their observation, no such relation appeared to exist. Yet, even with this explanation, the fact that the absence of any such connection or relation should have been noted in fourteen out of twenty-four localities, in some of which the disease seems to have raged with fearful violence, appears at first thought somewhat surprising, in view of the weight of medical testimony as expressed in the most recent publications, and in view, especially, of the strong ground taken on this subject by the leading sanitarians of the world. Yet, regarded in another and entirely legitimate light, the opinion expressed is in perfect accord with the view now held by many, that diphtheria is a specific disease, arising from a germ peculiar to itself, multiplying and repro-

ducing itself under favorable circumstances, but seldom or never arising *de novo*. To admit this to be true is no more unreasonable, in fact, than to admit the validity of the same belief as applied to scarlatina or measles. How often do we find outbreaks of these in isolated dwellings, or even in localities remote from those more or less recently affected? And how difficult it is to determine the route it traveled or the method of its stealthy approach. Yet we seldom hear a doubt arise as to the specificity of scarlatina. Though we cannot follow its uncertain steps, or unravel the mystery of its propagation, the fact that it has arisen from a specific germ or principle, or poison, has commonly received our assent. It is a part of our early education in medicine—it is a principle of the orthodox faith. That we do not all admit the force of the same doctrine, as applied to diphtheria, may be because the facts have not been so clearly demonstrated to our observation. There is, indeed, among the closest observers, a difference of opinion as to the causation of this disease, or the possibility of its arising independently of germ propagation, or whether this germ can ever originate *de novo*, even under circumstances supposed to be peculiarly favorable. It must be considered to be, as yet, an unsettled question.

Almost the same difficulty is involved in the question of the contagiousness of diphtheria; and although a large number of our correspondents agree as to the fact, it is difficult, with this as with other diseases similarly classified, to point out the precise source of the contagion, and we are not infrequently compelled to fall back upon the doctrine of the extreme vitality of the poison, its capability of being transmitted long distances by clothing and other tangible objects. Admitting the fact that the observations of the correspondents, in the several localities from which they write, have not been sufficiently demonstrative of the effects of local exciting causes during the past two years, it is believed that few of them would deny the pernicious influence of the factors above named. Some of them are earnest laborers in the sanitation of the districts in which they reside, and recognize to the fullest extent the evils of which the ordinary insanitary conditions are productive. They recognize the fact that disease—zymotic disease especially—is favored everywhere by uncleanliness, by dampness of soil and of the dwelling, and by overcrowding; that these exert a depressing influence on the system, lower the resistance to disease, predispose it to the easy receptivity of contagion, and render it less capable of sustaining an attack. There are no facts, indeed, in sanitary medicine more susceptible of proof than that this entire class of diseases find their favorite haunts amid the abodes of wretchedness and filthiness; that though they may in isolated instances, and sometimes even in their more general manifestations, seem to spare neither sex nor age, nor have respect to condition in life, yet they occur with far greater frequency and with increased fatality wherever the sanitary condition is bad, where the pure sunlight is shut out, wherever drainage, ventilation, and cleanliness have been neglected, and that, in proportion as these things are corrected, improvement in health follows and the death rate diminishes.

As having an intimate bearing upon the question of causation, attention is invited to the cases reported by Dr. G. L. Simmons, occurring in and near the city of Sacramento. In addition to what

has been stated by Dr. S. in his report, another important fact was mentioned by him to the writer—that the water in the well at the school house, though used by many of the children, was so nauseous that some were in the habit of taking pure water with them from their homes. We have here the two factors of impure air arising from the pig-pens and slaughter-houses, and contagion, and a possible *third*—unwholesome water.

While writing this report, cases of diphtheria have come under the observation of the writer in a family of five persons—father, mother, and three children—living in a small house, in a low, highly malarious portion of the city. Within a distance of perhaps eighty yards of this house runs the *drainage* canal, made for the purpose of conveying away the sewage of the city—an open ditch, five or six feet in width, and of varying depth. The water and sewage in this ditch are now diminishing in depth, exposing the earth upon each side to a process of drying, in the course of which exhalations of an offensive kind are given off. Within a few feet of the house are the privy—a vault four or five feet deep—and a small inclosure for chickens and ducks, exceptionally filthy. Fifteen or twenty feet from the privy is the well, bored to a depth of about twenty-eight feet. The soil about the house is a rich sandy alluvium, beneath which, at a depth of eight or ten feet, is a blue clay hard-pan impermeable by water. The surface around the well—the latter being on the slope at the rear door of the house—gave unmistakable tokens of having been the receptacle of the slops and the washings from the kitchen. Upon inquiry it was learned that the water in this well was not used for drinking purposes, under the impression that it was causative of ague, though it is questionable whether this rule was strictly obeyed by the children. Of this family of five persons, all had severe diphtheria; the mother first, then one of the children, the others following in rapid succession. One nurse, coming from a different part of the city where the disease did not prevail, was taken sick while on duty and compelled to return home, suffering with the same malady. It was stated that none of this family had recently visited other portions of the city, the children were not in attendance upon school, and, to all appearances, no opportunity had been afforded them to contract the disease away from home. It was said, however, that a sister of Mrs. —— had visited the family only a day or two before the latter was attacked, bringing with her a little girl who had a *fever* the day previous, and a slight enlargement of the submaxillary glands. Whether this was a mild form of diphtheria cannot be ascertained—no physician having been called and no medicine given. It is at least problematical. What was the etiology of the disease as it appeared in this family? If we deny, as some do, the possibility of the origin of the germ of diphtheria, under conditions such as have been described, we will be compelled to fall back on the theory of contagion, and admit the probability that the little child, who, with its mother, visited the family, really had the disease in a form so mild as to be unrecognized and unsuspected at the time. Yet, against this theory is the fact that only two days elapsed between the exposure and the appearance of the sore throat in Mrs. ——. The same doubt might arise as to the origin of the disease in the nurse—whether it arose from contagion or the [illegible]ntary surroundings.

[illegible] the uncertainty as to the causation of this disease, therefore,

the practical lesson is derived—a lesson which, in the interest of communities and of individuals, cannot be too frequently repeated or too earnestly urged—to avoid its possible sources: by cleanliness of the dwelling and its surroundings, by protection of the water from contamination, by the cleansing and disinfection of privies, by the ventilation of drains where these connect with sewers or cesspools, and by isolation of the sick. All of these things can be accomplished with little inconvenience and trifling cost.

There is another danger connected with the assembling of children in the school-room. Of this, the cases mentioned by Dr. Simmons are an illustration, teaching us by a sad, yet striking example, the danger of permitting children just recovering from an attack of diphtheria, or belonging to families in which it prevails, to associate in the school-room or at play with others. Such lessons are unfortunately often repeated in the history of diphtheria, yet seldom heeded. It is time that public attention was drawn to this danger, that parents should take the precaution to keep their children at home when one of the family is affected, and that those having authority should close schools in which the disease had made its appearance in a number of its attendants.

CONSUMPTION.

The statistics of consumption are interesting, showing a decided increase in mortality for 1878 over that of 1877. The difference may be, in part, accounted for by the greater number and regularity of the reports received during the former period, but mainly by the greater mortality by this one disease in some of the large cities of the State, notably San Francisco, Marysville, and Los Angeles.

The mortality set down to these and other cities is not so much to be considered a reflection on their local climatic influences, as to the tendency of invalids in all parts of the State to flock to these cities, many seeking charitable aid, medicinal or pecuniary, and, especially, the benefit of hospital care.

The same may be said of the somewhat startling mortality at some of the reputed health resorts of the State, these localities being sought by those desiring the benefit of a favorable climate, but at a stage of disease too late for help.

In connection with this disease, one of the most important subjects for consideration is that of a

STATE HOSPITAL FOR CONSUMPTION.

The necessity for the establishment of such an institution has been long felt. The subject has, on several occasions, been presented to the Legislature of the State and to the public. It is urged as a matter of economy to the citizens of the several counties, who might far better pay their share of a State tax for the purpose than themselves bear the burden of the support of those sick with pulmonary consumption. It is also a great humanitarian scheme. The county hospitals are in general not suited for the care of the class of patients under consideration. They are designed commonly for other diseases, for the treatment of accidents, for the care of paupers, many of them; and for those suffering from a class of chronic maladies for which hygienic treatment is, by comparison, of secondary import-

ance. Their locations are not always such as are best suited to the consumptive; for it is true of California as of other States that the climate of some portions is much more favorable for the purpose than that of others. If we are to have the unfortunate victims of the disease among us, surround them with all the comforts which a liberal government can bestow; give them all the advantages which a State, rich in its natural resources, is able to supply; give them pure air and a home selected especially for its adaptability to their condition, and we shall have fulfilled a duty which the dictates of a higher humanity demand.

The public, it is believed, is generally unaware how many consumptive patients find their way to California in the hope of regaining their health, and how few of these are prepared for the hard struggle for the means of support in a strange land, how they crowd into our large cities, frequent the different health resorts, especially along the coast and in the coast valleys, swelling the lists of mortality there, and reflecting injuriously on their reputations as sanitariums; how they ultimately seek admission into our hospitals on account of failing health or the want of the comforts of life. Doubtless more are driven there by absolute want than is generally supposed, who, if they had the means to pursue a different course, or could avail themselves of the advantages of a suitable hospital, or other sanitarium, in a judiciously selected locality, affording proper hygienic treatment, would ultimately recover and become useful and profitable citizens.

In the emergency in which these sufferers from disease and poverty find themselves placed, they can of course exercise no judgment as to the locality adapted to their condition. They generally seek the large cities—by preference the metropolis—where the climatic conditions are the very reverse of favorable.

John S. Hittell, Esq., a close observer and student of the resources of the State, in an article upon this subject, published in the Pacific Medical and Surgical Journal, April, 1879, states some facts which are worthy the attention of our legislators. "A large number of invalids," he says, "come from the interior to the metropolis for the benefits of its medical skill, private charity, and public institutions. About three hundred consumptives, two hundred of them from other counties, are admitted annually into the County Hospital, and the expense to San Francisco of these two hundred phthisical patients from other parts of the State is perhaps $13,000 a year, enough to provide for six hundred patients of other classes, since the consumptives live longer and cost more on the average than the others. The number of consumptives who die in the course of a year is to those admitted as seven to fifteen, and something of the proportion is to be charged to the unfavorable influence of our climate. * * * * *

"The establishment of a State hospital for consumptives would not only be a matter of benevolence to the invalid and of justice to San Francisco—though the latter is a comparatively small consideration—but also of general benefit to California, which would thus command attention, challenge comparison, stimulate the study of therapeutical climatology throughout the civilized world, and give prominence to the superiority, which I believe she has, as a resort to sufferers with diseases of the respiratory organs over every other part of christendom."

As an act of justice, then, to the counties of the State, as a humani-

tarian scheme for saving life and relieving the sufferings of the unfortunate, a measure in which the reputation of the State itself is involved, the subject ought, of right, to enlist the warm sympathies of the Legislature.

COUNTY HOSPITALS.

Reports have been received from eighteen hospitals, although every reasonable effort has been made to obtain the statistics of all known to be in existence. From the returns received there is gratifying evidence of an improvement in the condition of these institutions over those recorded in the last report of this Board. The rate of mortality and the number of patients under treatment may be seen by an examination of the tabular statements herewith submitted.

REPORT

To the State Board of Health of the Indigent Sick treated in the following Hospitals.

NAME OF HOSPITAL.	Number of months reported.	Total admitted and in Hospital.	Discharged cured.	Discharged.	Died.	Per cent. of deaths.	Remaining under treatment.	Period included in Report.	Name and residence of Physician.
Sonoma County	12	291	173	42	27	.09	49	January 1, 1878, to December 31, 1878	James Burns Gordon, M. D., Santa Rosa, California.
Tulare County	3	55	21	26	3	.05	5	January 20, 1879, to April 20, 1879	Martin Baker, M. D., Visalia, California.
Fresno County	24	143	101	116	13	.08	14	January 1, 1877, to December 31, 1878	Lewis Leach, M. D., Fresno, California.
Sierra County	12	46	11	18	5	.10	12	November 23, 1876, to November 23, 1877	George C. Chase, M. D., Downieville, California.
Sierra County	12	48	18	8	7	.14	15	November 23, 1877, to November 23, 1878	Alemby Jump, M. D., Downieville, California.
Shasta County	11	56	22	13	5	.09	16	February 1, 1878, to December 31, 1878	J. M. Briceland, M. D., Shasta, California.
Del Norte	12	8	5	.....	3	.37	.....	January 1, 1878, to December 31, 1878	J. W. Reins and F. Knox, M. D., Crescent City, California.
Central Pacific Railroad Hospital	12	1,921	1,869	13	10	.005	29	January 1, 1878, to December 31, 1878	A. B. Nixon, M. D., Sacramento, California.
Kern County	12	149	94	117	19	.12	3	February 10, 1878, to February 10, 1879	L. S. Rogers, M. D., Bakersfield, California.
Placer County	12	202	87	149	23	.11	48	January 1, 1878, to December 31, 1878	T. M. Todd, M. D., Auburn, California.
California State Woman's Hospital	24	*237	130	97	5	.02	5	January 1, 1877, to December 31, 1878	John Scott, M. D., San Francisco, California.
Stockton Insane Asylum	12	181	77	91	91	.06	1,174	January 1, 1878, to December 31, 1878	G. A. Shurtleff, M. D., Stockton, California.
Home of Inebriate	12	861	.....	854	7	.01	12	January 1, 1878, to December 31, 1878	A. P. Hayne, M. D., San Francisco, California.
Calaveras County	12	86	41	52	17	.13	17	January 1, 1878, to December 31, 1878	E. B. Robertson, M. D., San Andreas, California.
Yolo County	6	43	27	4	4	.09	8	November 1, 1878, to April 30, 1879	Thomas Ross, M. D., Woodland, California.
Los Angeles	6	193	112	16	21	.10	44	November 1, 1878, to April 30, 1879	J. Hannon, M. D., Los Angeles, California.
Napa Asylum for Insane	24	1,048	332	293	174	.08	714	June 30, 1877, to June 30, 1879	E. T. Wilkins, M. D., Napa City, California.
Sacramento County Hospital	12	963	.....	789	56	.06	118	December 3, 1877, to December 3, 1878	G. A. White, M. D., Sacramento, California.

* Out-patients, 798 additional.

TABLE No. 2.

Principal Diseases reported from Hospitals.

NAMES OF HOSPITALS.	DISEASES OF THE RESPIRATORY ORGANS.				FEVERS.					Disease of brain and nervous system	Bright's disease and nephritis	Diseases of the liver	Diarrhœa and dysentery	Other diseases of stomach and bowels	Diphtheria	Heart disease	Aneurism	Erysipelas	Rheumatism	Alcoholism, including delirium tremens	Cancer	Venereal diseases	Other diseases	Accidents	Totals	By whom reported.
	Consumption	Pneumonia	Bronchitis	Other diseases of respiratory organs, including influenza	Typhoid	Typho-malarial	Remittent	Intermittent	Cerebro-spinal																
Sonoma County	16	----	----	17	*27	----	----	----	----	12	----	13	----	----	----	----	----	----	27	----	6	12	115	46	191	J. B. Gordon, M. D.
Tulare County†	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	Martin Baker, M. D.
Fresno County	6	5	8	4	1	----	‡33	----	----	12	6	1	3	7	----	----	----	----	14	----	1	22	13	7	143	Lewis Leach, M. D.
Sierra County	2	1	----	2	----	----	‡1	----	----	4	1	1	----	1	----	----	1	2	7	4	----	2	12	5	46	Geo. C. Chase, M. D.
Sierra County	3	2	1	----	2	----	----	----	----	10	1	----	1	1	----	2	----	2	2	2	----	----	13	6	48	Alemby Jump, M. D.
Shasta County	----	1	----	----	----	2	‡13	----	----	6	----	----	----	2	----	2	----	----	10	2	1	1	14	2	56	J. M. Briceland, M. D.
Del Norte County	1	----	----	----	----	----	----	----	----	1	----	3	----	----	----	----	----	1	----	----	----	1	2	----	8	Drs. J. W. Reins and F. Knox.
Central Pacific Railroad	6	36	4	287	6	----	‡811	----	----	36	6	4	----	104	2	5	----	3	153	----	1	----	180	267	1921	A. B. Nixon, M. D.
Kern County	----	11	5	----	----	20	‡41	----	----	2	----	----	1	----	----	----	1	8	14	6	----	----	30	10	149	----
Placer County	7	5	6	2	2	----	‡44	----	----	21	2	1	6	3	----	2	----	----	33	8	2	7	36	12	199	T. M. Todd, M. D.
California State Woman's	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	9	228	----	237	John Scott, M. D.
Stockton Insane Asylum	----	----	----	----	----	----	----	----	----	§181	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	G. A. Shurtleff, M. D.
Home of Inebriates	----	----	----	----	----	----	----	----	----	341	----	----	----	----	----	----	----	----	----	520	----	----	----	----	861	A. P. Hayne, M. D.
Calaveras County	3	----	2	----	----	----	‡5	----	----	13	2	----	----	1	----	----	----	6	10	----	2	4	25	13	86	E. B. Robertson, M. D.
Yolo County	2	4	----	2	----	2	8	----	----	5	----	----	----	----	----	----	----	----	6	2	----	5	6	1	43	Thos. Ross, M. D.
Los Angeles County	36	3	----	12	1	----	‡2	----	----	33	2	----	----	3	----	1	----	----	37	----	2	11	24	11	178	J. Hannon, M. D.
Napa State Asylum for the Insane	18	4	----	1	1	----	----	----	----	76	----	----	----	5	----	----	1	2	----	----	1	----	60	‖4	173	E. T. Wilkins, M. D.
Sacramento County	33	7	12	22	15	----	50	139	----	49	----	8	8	14	1	7	----	----	39	28	2	81	155	65	737	G. A. White, M. D.

* Including typhoid, intermittent, and remittent.

† Not reported.

‡ Remittent and intermittent.

§ The insane are received (according to Act of the Legislature, 1876) and detained until examined by the Commissioners of Insanity. In cases of doubt they are returned and detained until all doubt is removed —A. P. H.

‖ One homicide and two suicides.

Report

To the State Board of Health of Deaths in the following Hospitals.

Name of Hospital.	Diseases of Respiratory Organs.				Fevers.					Disease of brain and nervous system	Bright's Disease and nephritis	Disease of the liver	Diarrhœa and dysentery	Other diseases of stomach and bowels	Diphtheria	Heart disease	Aneurism	Erysipelas	Rheumatism	Alcoholism, including delirium tremens	Cancer	Venereal diseases	Other diseases	Total accidents	Totals
	Consumption	Pneumonia	Bronchitis	Other diseases of respiratory organs	Typhoid	Typho-malarial	Remittent	Intermittent	Cerebro-spinal															
Sonoma County	7			3		*2				2									1		5		2	5	27
Tulare County		1				1																	1		3
Fresno County	5	1	1		1								1								1	1	3		14
Sierra County	2			1								1					1								5
Sierra County		1								1						2							3		7
Shasta County		1														1					1		2		5
Del Norte												2						1							3
Central Pacific Railroad Hospital	2			1	2						1	1		1		1								1	10
Kern County		2	1			4	1			1							1						7	2	19
Placer County	2	3	2							1	1		1			2			1		1	1	8		23
California State Woman's Hospital																					1		4		5
Stockton Insane Asylum	25	2		1		1					39	1	2	2		2							16		
Home of Inebriates																				7					7
Calaveras County	2		1					1		5								2			1		4	1	17
Yolo County	2	1		1																					4
Los Angeles	13			1						4															18
Sacramento County Hospital	14	2		1	4		2			10		6		1		4				2		1	7	2	56

* Including typhoid, remittent, and intermittent.

The remarks of the physicians in attendance, made in connection with their statistical reports, will throw some light on the condition of the hospitals and the diseases treated.

Dr. J. B. Gordon, of Sonoma County, says:

You will observe that the death-rate is *high*, and the number of *cancer* cases extraordinary. There have been really *six* deaths from cancer, though I report but *five*, as my record was made up before a post-mortem revealed cancer of the kidney. The great number of fever cases reported is accounted for by a very large number of residents of our county working during harvest time in the Sacramento Valley, and returning home late in the fall with intermittent fever, usually with typhoid tendency. Several cases of *paralysis* are traceable to working in the quicksilver mines of this and adjoining counties; and, last year, I admitted two cases of gangrene of the lungs, directly traceable to that kind of work. * * * Probably one-half of the pulmonary cases are from the lumber mills and logging camps on the coast. The climate of the coast is very bad—immediately upon the coast, during the summer, westerly winds prevail —cold and moist—while a mile or two back where the timber is cut the temperature is from 90° to 100°. You can conceive the effect of such changes upon the laborers, who are employed all day in the heat of the woods, coming down to the coast at night-fall where their boarding-houses are generally situated.

Dr. Martin Baker, of the Hospital in Tulare County, writes as follows:

The County Hospital is located in the northeast portion of Visalia, away from the business portion of the town, upon high ground, which is well drained and set out with shade trees, the eucalyptus interspersed. The building is two stories in hight, and is divided into twelve wards, with a fire-place in each. It is capable of accommodating thirty-six patients. The rooms are twelve by sixteen and well ventilated. We have recently added a dead-house on a corner of the grounds, away from the main building, and have built an additional building to the hospital that will accommodate ten more patients. Visalia has facilities for drainage which many cities of the plains might envy. A branch of the Kaweah River runs directly through the city, with banks eight feet high. The pure sparkling water comes directly from the mountains, but fifteen miles distant. This creek is made the receptacle of all the sewers of the city.

Dr. Lewis Leach gives the following account of the Hospital in Fresno County:

The Fresno County Hospital was built upon a block of ground containing three and one-half acres, and said block is four blocks from Court-house. The main building is seventy-five feet in length by twenty-five in breadth, with two wings, each twenty-four by thirty and seventeen feet in hight, separated by a hall twelve feet in width. The rear forty-six feet of the main building is used for kitchen, dining-room, and two sleeping rooms. The anterior portion of the main building contains dispensary and one room for general use. The two wards above spoken of are said to contain (builder's estimate) 16,200 cubic feet of air, and would give eight patients per ward over 2,000 feet each. The wards are warmed by fire-places, one in each ward; ventilation from transoms and windows; sewerage good as far as tested. The building has been in use eighteen months. Supplies are the best that the market affords. Water is furnished by the Fresno Water Company, is raised by steam power from a well eighty feet in depth, and conveyed to the hospital in iron pipes. The entire management of the hospital is with the County Physician, who has discretionary power to purchase whatever he may deem necessary for the benefit of his patients. He also furnishes his own medicines, and at the end of each month makes out his bill for medicines furnished and services rendered, which, with all other bills, are placed before the Board of Supervisors, and have always been allowed.

Dr. Alemby Jump, of Sierra County, adds the following to his statistical report:

The building occupied by this county for hospital purposes has been condemned by several grand juries. Ventilation is bad. Water supply and drainage are very good. Sewage goes into the river, upon which the lot borders. The supplies are furnished on contract by the lowest bidder. Medical supplies are purchased by the physician when required. When there are eighteen patients in the house there will be seventy-seven feet of square surface to each.

Dr. J. M. Briceland, of Shasta, says:

Shasta County Hospital is located three-quarters of a mile west of the Town of Shasta, on

elevated ground, affording excellent drainage. Buildings, one story, fourteen feet high, constructed of lumber, and unfinished; divided into seven rooms, dining-room, kitchen, and four rooms for patients, and one for office. Largest room, eighteen feet square. All are well ventilated, with sunny exposure. About one hundred feet west, second building, also frame, and one story high, thirty by eighteen, constituting one large room for six beds. Two hundred feet east is located the steward's residence. The whole is inclosed within about two acres, with shade trees, and supplied with excellent water from deep well. Sewerage good. The hospital is for the comfort and medical aid of indigent sick, without distinction of race, color, sex, or religion.

Dr. L. S. Rogers, of Kern County, explains the percentage of deaths in the hospital under his charge by the statement, that "a number of the patients were so near dead on being carried into the hospital that they did not live an hour; and many others did not live twenty-four hours, or long enough to derive any benefit from treatment. Our building is large enough for our necessities, and as good as our mild climate needs. Water is supplied from a well, and is as good as can be had in this locality."

A visit to this hospital during the present year enables me to add that the building used, though not erected especially for a hospital or arranged according to modern hospital architecture, is well located, the wards ventilated, and each one sufficiently capacious for the probable inmates. Its management seemed to be unexceptionable, though carried on under the contract system.

Of the State Insane Asylum at Stockton, Dr. Shurtleff, the Superintendent, gives the following facts:

Location at Stockton, on rich, level, valley land, about one and one-fourth miles from tule border; fall sufficient for drainage by extending pipes to tule border.

Sewage taken away from buildings in proper pipes supplied with clear water; but it is not taken a sufficient distance, though no sickness has resulted from defective sewerage apparently.

Ventilation good in the principal buildings.

Supplies of food, clothing, and fuel ample.

Medical attendance: Three physicians, who are required to devote their professional services to the Asylum exclusively.

Surface area to each patient: In the best wards of the female department there is a surface area of one hundred and twenty square feet to the patient; but there are two wards in the male department densely crowded, poorly ventilated, and below any reasonable standard of accommodations.

Time occupied, twenty-six years.

Water supply good. The water is of good quality and sufficient quantity. It is raised by steam power to reservoirs of upwards of fifty feet elevation.

Dr. Thomas Ross writes regarding the Yolo Hospital:

Yolo County Hospital is situated in a five-acre lot, about one-fourth of a mile south of Main Street, Woodland. Is surrounded with shade trees, many of which are eucalypti. The main building is seventy feet long and forty-five feet wide, having a wing on the northeast side thirty-six feet long and thirty-two feet wide, which is divided into a store-room, thirteen feet by eleven and one-half; kitchen, seventeen and one-half feet by eleven and one-half feet; a small ward, thirteen feet by thirteen and one-half feet, containing two beds, and a portion of a dining-room, eighteen and one-half feet by thirteen feet. A hall six feet wide runs back from the main entrance for forty feet. On each side of this hall are two wards. Those on the south side measure twelve feet by thirteen and one-quarter feet, containing two beds, and twenty-eight feet by thirteen and one-quarter feet, with six beds. On this side also is a small bath-room, five feet by seven feet, and a store-room, five feet by six feet. On the north side of the hall are two wards, one thirteen and one-quarter feet by twenty-four feet, containing five beds, the other twenty-one and one-half feet by thirteen and one-quarter feet, containing four beds. The hight of the ceiling in all the wards is twelve feet. The whole number of beds is nineteen. At the end of the forty-foot hall is another hall, running at right angles with the former, the dimensions of which are thirty-five feet by ten feet, in the center of which during the winter a stove is placed. Back of this hall is the surgery, thirteen feet by fourteen feet, and the Warden's room, size, thirteen by fourteen feet. A porch, twelve feet wide, is placed on the west end and south side of hospital for its whole length. Three acres are well set in alfalfa, which affords ample feed for the two cows which belong to the hospital. About one acre is used for the cultivation of vegetables. The hospital is ventilated by windows, which slide either up or down

and transoms over the doors. The sewage is conducted to a cess-pool, which is covered, having a flue extending about twelve feet in the air, and is situated fifty feet from the hospital, on the north side. Bids are received by the Board of Supervisors every three months for hospital supplies, and the lowest bid always gets the contract. Good groceries and meats, however, are generally furnished by parties receiving the contract. The physician is appointed by the Board of Supervisors, and holds his position subject to their pleasure. He receives a salary of $100 per month. He is expected to visit the hospital at least once daily, to supply medicines, and to attend the indigent sick in the county, for a distance of fifteen miles from Woodland. The hospital is supplied with water from the town water-works. This water is pumped from two wells, each of which is two hundred feet deep, eight-inch bore inside, to a tank fifty-five feet high, which has a capacity of 23,000 gallons. This water is good, clear, and soft. The hospital has been occupied for seventeen years, being built in 1862. The surface area to each patient, including all the wards irrespective of partitions, and considering a patient in each of the nineteen beds, is about seventy-four feet—not enough, however. The average of patients in the hospital at one time for the past two years is eight. During the months of May, June, July, and August, the hospital is occasionally crowded to its fullest capacity. Then it is our practice to place beds on the porch on the south side of the hospital, and have convalescents sleep there, thus avoiding overcrowding. Eastmond & Cotier's pneumatic principle or patent, for the ventilation of privies, etc., is applied to all the water-closets.

WOODLAND, May 20th, 1879.

Dr. Wilkins, in connection with his report for the Napa State Asylum for the Insane, gives the following statement of the length of time those dying had remained in the Asylum:

One day	2	Three and a half months	2
Five days	2	Four months	4
Six days	2	Four and a half months	1
Seven days	1	Five months	2
Eight days	2	Six months	3
Ten days	2	Seven months	2
Thirteen days	1	Eight months	2
Fourteen days	1	Nine months	1
Sixteen days	4	Ten months	3
Seventeen days	1	Eleven months	4
Twenty-five days	1	One year and less than two years	12
One month	3	Two years and less than three years	7
One and a half months	2	Three years	2
Two months	5		
Two and a half months	4	Total	89
Three months	11		

With regard to the Napa Insane Asylum, Dr. Wilkins writes:

The Napa State Asylum for the Insane was opened for the reception of patients on the 15th day of November, 1875, though not completed until the present year. It is located in one of the most beautiful valleys in the State, and every view from the hospital is a pleasing picture. The climate is salubrious and pleasant, the temperature equable, being a mean between that of the Sacramento Valley and the Bay of San Francisco, and the statement of the Commissioners, who selected the location, that, "taking all things into consideration, it is confidently believed that no asylum in existence combines more advantages of location than pertains to this," has been fully sustained by the opinion of all visitors of good judgment.

It is situated one and a half miles southeast of Napa City, at an elevation of forty feet above the low lands, affording excellent sewerage facilities, of which advantage has been taken in the construction of the sewers for the Asylum, which faces the west, and consists of a center building with wings extending on either side, and are exactly alike, twelve wards on each side—one wing for males, the other for females. In addition to these there are two large dormitories in the center building, one on the fourth floor and the other in the attic, for forty-four male patients each. The Asylum was designed to accommodate five hundred patients, which was increased to the extent of forty-four patients by furnishing and fitting up the attic. But experience has demonstrated that in these twenty-six wards one hundred additional patients can be accommodated comfortably and safely. It has also demonstrated that the four hundred and fifty-five male patients, now kept in fourteen wards, are more than can be kept with safety, and that under the present pressure proper classification is impossible; as is always the case when two insane persons are confined in a single room or placed upon an open corridor. The ventilation is all that could be desired, and consists of a window in each room communicating with the outside air, transoms over the doors, and a ventilating flue. The water-closets are furnished with downward currents of air through an arrangement of pipes terminating in the smoke-stack of the boiler-house.

The wards are heated by steam, and lighted with gas made upon the place. The water sup-

ply is brought in pipes from mountain streams, and conducted to the tanks in the towers above the roof. It is of good quality, and an abundant quantity for hospital purposes, with several thousand gallons per day for irrigating the grounds.

The surface area was intended to be 1,000 feet to each patient, but two patients in a single room lessen this fifty per cent. The medical staff consists of a Resident Physician and two Assistants.

Supplies are furnished by contract from the lowest responsible bidders, after due notice given by advertising, and are let semi-annually.

With the exception of the occasional prevalence of diarrhœa and colds, the diseases are indicated in the table setting forth the causes of death.

What we most need are two infirmary buildings for the accommodation of, say twenty patients each, as designed in the original plan. Patients suffering from acute physical disease, or prostrated from chronic diseases or any other cause, require different treatment from the ordinary cases to be found in an asylum for the insane. And it is to supply this deficiency and this necessity that these infirmaries are required.

TABLE

Of maximum, minimum, and mean temperatures, and the relative humidity at Napa Insane Asylum, from July 1st, 1878, to June 30th, 1879.

1878.

	July.			August.			September.			October.			November.			December.		
	D. B.	W. B.	R. H.	D. B.	W. B.	R. H.	D. B.	W. B.	R. H.	D. B.	W. B.	R. H.	D. B.	W. B.	R. H.	D. B.	W. B.	R. H.
Max.	89°	70°	35	86°	74°	54.	90°	76°	50.3	82°	70°	52.4	68°	60°	60.1	68°	59°	55.7
Min.	48	50	86.1	48	47	92.5	42	45	77.7	40	42	82.9	34	34	100	26	22	51.5
Mean*	64.5	64.5	100	64.5	59.9	77.6	61.6	56.3	71.3	58.8	53.7	69.8	51.5	48.8	85.6	45.	40.4	83.6

1879.

	January.			February.			March.			April.			May.			June.		
	D. B.	W. B.	R. H.	D. B.	W. B.	R. H.	D. B.	W. B.	R. H.	D. B.	W. B.	R. H.	D. B.	W. B.	R. H.	D. B.	W. B.	R. H.
Max.	62°	57°	71.8	67°	60°	64.2	75°	62°	44.1	78°	76°	90.8	80°	74°	74.1	88°	84°	83.9
Min.	29	27	77.5	34	31	71.2	36	36	100	38	42	69.1	38	40	82.9	46	51	68.7
Mean	43.2	41.8	91.4	50.9	48.7	85.6	54.	52.1	93.2	56.6	55.5	93.5	56.9	55.1	93.5	64.8	53.8	43.2

* Mean of all observations.

With regard to the Hospital at Los Angeles, the writer takes pleasure in indorsing, after personal examination of the institution, the following from the pen of Dr. Gibbons, President of the State Board of Health:

It is located about two miles from the heart of the city, in a spot well chosen for drainage, elevation, and surroundings. The house has been recently built, and everything is yet new and unfinished. The grounds contain nearly forty acres, appropriated to a vegetable garden and pasturage for cows, now available, an orchard of fruit trees just planted, and several acres in readiness for an orange orchard. A neat and clean dairy is near the house, and a copious supply of milk and butter is on hand. The laundry, kitchen, and everything else that is required, are conveniently arranged. The water is good and the supply abundant, the water being conveyed in pipes from a short distance. The drainage is natural and perfect.

The building contains eleven wards, capable of accommodating one hundred patients. Many of the inmates are paupers, and nearly all the work of the hospital and farm is done by them and by the convalescent patients. There are, at present, sixty or seventy persons in the wards.

The cost of maintaining the patients, including interest on all investments and expenditures, is forty-five cents a day for each individual, and there is a prospect of some reduction

from this figure. Taking into view everything within and without, I came to the conclusion that, with the completion of the present designs, the Los Angeles County Hospital will be the most complete in the State. It should not be forgotten that the credit is due to members of the medical profession.

Prior to the occupation of the hospital the indigent sick were maintained by contract at an expense of seventy-five cents each per diem, to which the cost of drugs and other things was added, bringing the entire expense up to nearly one dollar.

DESCRIPTION OF THE SACRAMENTO COUNTY HOSPITAL.

This hospital was designed by N. D. Goodell, Architect, of Sacramento, on the pavilion plan. The following description of the building has been kindly furnished by that gentleman:

The hospital consists of six buildings, viz.: one main or central building and five wings, each of the wings standing thirty-two feet from the main building and placed so that their inner ends form a half octagon. The main building is, in size, forty-four feet front by fifty-two feet deep, and in hight two stories and mansard roof above basement. The main floor is placed five and a half feet from the ground, thus securing a free circulation of air under the building; the first and second stories are each sixteen feet high in the clear, and the attic story twelve feet. This building has also a tower eleven by eleven feet and twenty feet high, surmounted by a flag-staff, etc. In front of main building is a broad flight of steps leading up to the main entrance, which opens upon a hall ten feet wide extending the whole length of the building. At the rear of this hall is a wide flight of stairs, handsomely finished with black walnut rail and balusters and neat scroll brackets, leading to the second story and attic. The front room in first story to the right on entering the main hall is the parlor; on the left is the operating room, with small bed-room, bath-room, water-closet, etc.; on the left, at the rear, is the library, and on the right the dispensary. The dispensary has been fitted up with neat and convenient fixtures in the shape of counters, shelving, drawers for drugs, sink, etc. The second story is divided into rooms the same size as those in the first story and closets, etc.; there are also six chambers in the attic story. There is also a cross hall, eight feet wide, in both first and second stories of main building, running at right angles with the main hall described above, and leading to an outside door on either side of the building, connecting with the corridors leading to the several ward buildings. On the end towards the main building, and running back on each side of the several ward buildings, are piazzas, eight feet wide, on both first and second stories, making a promenade over two thousand feet in length, and at the same time connecting all the ward building with the main building. There are one or more flights of stairs in each of the ward buildings (seven flights in all) leading from the second story to the ground, thereby giving, in case of fire, ample opportunity to escape from the building. Each of the several wings is twenty-four feet wide and eighty-seven feet long and two stories in hight, each story being sixteen feet high in the clear. At the rear end of each ward are three water-closets, two bath-tubs, and four stationary wash stands in each story. The dormitories are each twenty-three by seventy-seven feet, including the nurse's room, twelve by twelve feet, which occupies one corner. Each dormitory will contain eighteen beds, which will give each patient over fourteen hundred cubic feet of air. Four of the ward buildings are exactly alike, as described above. The other wing, which is the center one, situated directly back of the main building, is of the same size and hight as the other four, but is arranged somewhat differently. In the first story is a dining-room twenty-three by fifty-six feet, kitchen, sixteen by twenty feet, store-room, pantry, closets, etc., and a back hall and stairs leading to the basement and second story. The basement is finished off into laundry, store-room, etc. The second story is divided into rooms for female patients, with dining-room, china closets, bath-room, wash-basins, linen closets, etc. For the admission of fresh air there are four twelve-inch tin tubes for each ward, laid between the floor joists and leading from the outside to the center of the building; the flow of air is regulated by means of large registers placed in the floor, two tubes leading from each side of the building. For the escape of vitiated air there is a chimney in the center of each ward building, with two large fire-places in each, and in addition to the fire-places are four wooden flues, two on each side of the ward, with two grated openings in each flue—one near the floor, the other near the ceiling. These flues extend up through the roof of the building and are capped with iron cowls, which revolve with the wind, and prevent any sudden drafts down the flues. There are three-inch vent pipes leading from the traps of the several water-closets and coming out through the roof of the building. There is also a wooden flue, eight by twelve inches, leading from the seat of each water-closet throughout the building and terminating with an iron cowl five feet above the peak of the roof. By this contrivance the water-closets, bath, and wash-rooms will be kept free from all impure air. In connection with the ventilation it will be noticed that the shape and arrangement of the buildings is such as to catch and concentrate any breeze that may be stirring, keeping up a circulation of air around the buildings, no matter from what quarter the wind blows. In addition to and independent of the fire-places in the wings and center building, the hospital is heated throughout by the Harvey system of hot water heaters, which produces a very mild and pleasant heat, very different from the dry scorching heat produced by many systems of heating, the furnace, etc., being placed in the basement of the main building, with radiators in each of the several wards, rooms, etc.

WATER SUPPLY.

It was designed, under this heading, to give a somewhat detailed account of the water supply of a considerable number of the cities and towns of California, but the inability to obtain analyses of the water used for household purposes and the failure of some, mainly in the larger cities, to give any response to the communications addressed to them, has rendered the accomplishment of the undertaking impracticable for the present. Much valuable information has been obtained, however, from the replies of other correspondents to the questions sent to them, affording at least a partial idea of the resources of the State in this connection.

The importance of this subject requires no argument to demonstrate. It is one of those things with which the public, no less than the professional mind, has been of late years considerably occupied, and yet one which, in view of the magnitude of the interests involved, can not be too closely considered. Yet, there is a wide-spread carelessness observable even now among intelligent citizens in regard to sanitary matters generally, and in none more than in that which relates to the water used for domestic purposes.

The sources of a water supply in general may be considered to be wells, shallow or deep, lakes, springs, rivers, and the rain. Each of these has its advantages and disadvantages. The wells are liable to contamination by surface water and by percolation through a soil overcharged with the contents of drains, cess-pools, or privy vaults; the rivers are often polluted by washings from the neighboring lands, and by impure material drained or emptied into them by residents along the banks; the springs, even though pure at their sources, by impurities received by the water *in transitu* or in the reservoirs for storage and distribution, not to speak of the danger from chemical action upon lead and other pipes; and the rain or cistern water, by the dust and organic matters accumulating on the roofs of houses or in the gutters leading therefrom.

These sources of supply are not all of them equally available, however, at all times. In some of the valley towns in the interior of California, wells, for instance, constitute the only resource. A majority of these are shallow, twenty-five to thirty-five feet or less; the water, many times clear, colorless, but hard and alkaline. No analysis has been made of the well water of any locality so far as the information of the writer extends; but this hardness is believed to be universally of that kind considered temporary, i. e., removable by boiling. It is frequently surface water, purified from organic matter by percolation through the soil. With those accustomed to the use of other water, it is apt to occasion intestinal disturbance. Apart from these objections and inconveniences, which are sufficient to induce cities and towns, favorably located for the purpose, to obtain their supply from other sources, there is everywhere, where closely built towns have sprung up, danger of pollution from proximity to privies and cess-pools, where there are any. The latter, however, partly on account of the slight depth required to reach water, have commonly been discarded for the more primitive custom of emptying the slops and refuse of the house and kitchen upon the surface near the rear door, whence it gradually trickles down toward the well, or is imperfectly drained away to a more distant part of the yard, in either case serving to surcharge the soil with organic matters prone to decomposition.

The topography of many of these towns is such that sewerage is impracticable, and drainage difficult and expensive. The former might, however, be very much improved, at small cost, by building, under the direction of the town authorities or of the Board of Health, a sufficient number of perfectly water-tight cess-pools, care being taken that they be sufficiently small to require at least a semi-annual cleansing. The contents might be utilized on the neighboring ranches. If the drains leading into these cess-pools were properly trapped and ventilated, there would be the least possible danger of water contamination from this source. If, in addition, the privies were built in the same manner, completely water-tight, emptied once or twice a year, and suitably ventilated, the danger would seem to be in a great measure obviated. The facility with which vaults and cess-pools are now cleansed by the odorless excavator renders the plan suggested comparatively inexpensive. Cess-pools, however, are only to be tolerated from necessity. Insecure cementing, defective traps, and imperfect ventilation render them more or less liable to do harm. Other methods of disposing of sewage will be spoken of in another place. Some of the valley towns, suitably located, have adopted the plan of deeply bored wells or artesian wells, thus avoiding many of the dangers to which shallow wells are subject. Such is the case, to some extent, in the Santa Clara Valley and in the City of San José, which contains numerous artesian wells from fifty to three hundred feet deep; at Stockton, in the San Joaquin Valley, where water is obtained at a depth of twelve hundred and two feet; at Bakersfield, and Visalia in part, Kern River supplying the former place with the greater portion of its water; at San Bernardino, the usual depth being one hundred and twenty feet; at Woodland, and some other towns. The water thus obtained is usually clear, tasteless, and, apparently, of good quality.

Other valley towns, located within a reasonable distance of the mountains, seek to obtain their household water from springs, in the latter, bringing it in by ditches and pipes, and collecting it in reservoirs for distribution. Red Bluff is one example among several, the supply being of excellent quality. The principal danger to which such water is exposed, provided it be pure at its source, lies between the latter and the reservoir. Open ditches or conduits are liable to be variously contaminated—by surface washings from the soil, by the leaves and branches of trees, by roaming cattle, and by mineral matters from cultivated land. Springs, when distant from the point of supply, are equally, or almost equally, subject to contamination with rivers, upon which a large class of our population rely for household purposes. Of the rivers thus utilized the Sacramento may be considered the type. This stream, commencing in the northern portion of the State, pursues a southerly direction for a distance of about three hundred miles, and empties into Suisun Bay about sixty miles below Sacramento, the Capital of the State. During its course, besides several minor settlements above and below Sacramento, it passes by the once flourishing town of Shasta, by Red Bluff, with its increasing population, Princeton, Colusa, Knight's Landing, and Fremont. The latter is about twenty-five miles above Sacramento, near the junction of this river with the Feather River, which, loaded with the debris of mines, gives to the Sacramento the opaque muddy appearance so generally objected to by strangers visiting the Capital. Above the junction of the Feather the Sacramento, except during the rainy

season, is nearly clear. The character of this suspended sediment will be seen hereafter. Though unsightly and objectionable, or even repulsive to those accustomed to the use of clear water, there has been no evidence adduced to excite serious suspicion of its unwholesomeness. Filtered, as is now done by many private families, the water of the Sacramento seems to answer all the sensible tests of purity, being clear, tasteless, soft, and odorless even upon standing. Rarely, during extremely low water, it has been observed to lose this latter characteristic upon exposure in a vessel over night. Instead of filtering the water, many accomplish the same purpose by the use of alum, which, unless added in excess, as it frequently is, does not appear to affect its sensible qualities or render it objectionable in a sanitary point of view. Even a very small proportion of alum is sufficient—from some experiments made, not more than five or six grains to the gallon. Indeed, it is questionable whether the alum, besides precipitating the suspended sediment, does not act, in some degree, upon the organic matters in solution.

The rationale of the action of the alum upon the sediment in the water is simple—the formation of the sulphate of lime, and of a hydrate of alumina, which carries down with it the floating impurities.

The question of the pollution of streams becomes an important one in the consideration of the adaptability of the water of the Sacramento River to domestic use. There is a State law designed for the protection of all our rivers, but it is well known to be so constantly violated as to be practically inoperative. Indeed, laws which require for their observance some sacrifice of personal convenience, especially when nothing more serious than health or life are concerned, are seldom capable of fully satisfying the cravings of human selfishness, or of commanding general obedience. It is more convenient for the towns along the river to drain their sewage into it than to seek other and more expensive and sometimes almost impracticable methods in a different direction. It is more convenient for persons with families residing along the river banks to erect privies in such a manner that the fecal discharges are deposited directly into the water, and to drain off the sewage from the houses, stables, and pig-pens into the stream—and so these things are done.

To effectively prevent the continuance of these pernicious practices would require extraordinary measures—scarcely less than the establishment of a sanitary cordon along the line of the Sacramento River, from Sacramento to Red Bluff. In view of these facts, showing very evidently the pollution, to some extent, of the water of the Sacramento River at different points along its course, the interesting question arises—a question of practical importance to all residing along its banks and using its water for domestic purposes—is this water deleterious, or such as may become so under favoring circumstances?

It must be remembered that river water may contain a certain amount of sewage and yet respond favorably to all physical tests of good water; it may even contain a quantity in excess of what is considered by the highest authorities to be compatible with safety, and be used from year to year with impunity, until, upon the outbreak of an epidemic, as of typhoid fever or cholera or dysentery, its presence is made known by fearful demonstrations of fatality. Those who drink it may escape for a time; but their situation is like that of those who live upon a mine, which needs only the application of a

match to explode. There is danger in it, and we have no right to conclude from the apparent innocuousness of a given water, as exemplified by those who habitually use it, that it is of standard purity. Custom may habituate the stomach to the most extraordinary resistance to morbific impressions; and the intimate admixture of even the foulest sewage with a sufficient quantity of water—estimated at one hundred times its volume—has been thought to render it safely potable in the quantities commonly used by individuals. The greater the dilution, the less the danger. All water, as discovered in nature, especially all river water, is more or less impure, and the measure of its adaptability to use is that of the comparison of volumes.

One of the most interesting questions involved in this subject is that of the self-purification of running water; yet, it is one about which the highest authorities differ. The English Rivers-Pollution Commission are emphatic in the denial of any such purification, at least to an appreciable extent. The result of all the examinations made by this learned commission is thus summed up: "We are led in each case to the inevitable conclusion, that the oxidation of the organic matter in sewage proceeds with extreme slowness, even when the sewage is mixed with a large body of unpolluted water, and that it is impossible to say how far such water must flow before the sewage matter becomes thoroughly oxidized. It will be safe to infer, however, from the above results, that there is no river in the United Kingdom long enough to effect the destruction of sewage by oxidation." The experiments of the commission were made upon the Thames and other rivers of England.

The Massachusetts reports upon this subject agree substantially with those of the English Commission. "It was long thought," they say (State Board of Health Report, 1876), "that sewage was destroyed by running water, but now it is believed by chemists to be all but indestructible there, and to be rendered insensible, as already said, and inert, only by being mixed largely—thoroughly diluted, in other words—with at least one hundred times its volume of good water."

The influence of dilution has been before referred to. It is of great importance, and to its conservative agency is thought to be due the exemption from severe epidemic disease of several of the large cities of the United States using river water.

The reports of correspondents will serve to throw additional light upon the water resources of the State, as well as to illustrate some of the facts mentioned in the preceding remarks. They embrace nineteen cities and towns, and contain answers to some or all of the following questions:

1. From what source does your town or city obtain its water supply for domestic use?
2. If from lakes or mountain streams, by what means is it conveyed from its source?
3. Is the lake or stream from which your supply is obtained liable to contamination from sewage or otherwise?
4. Is the water liable to contamination between its source and the town or city?
5. Has there been any evidence of disease from this source?
6. If the supply is from wells, what is their usual depth?
7. Is there any reason to suspect the contamination of the wells by proximity to privies, cesspools, or drains?
8. If the supply is from rivers, are these rivers used to receive the sewage of your own town or city, or of other towns? If so, please state facts as far as they are known to you.
9. Is the water supplied for use considered to be of good quality? Is it clear, tasteless, hard, or soft?
10. Has any reliable analysis been made of it? If so, please state the results.
11. Is the supply abundant?
12. Is the town or city supplied by public works or by private enterprise?

To these questions replies have been received from 23 localities, which, without being repeated in full, may be summed up as follows, viz.:

Question No. 1—Supplied by wells, 5; by wells and rivers, 4; by wells and lakes, 1; by wells and springs, 5; by wells and mountain streams, 3; by wells and rain-water collected in cisterns, 1; by shallow and artesian wells, 1; by artesian wells and lakes, 1; by mountain springs and streams, 1. In most of the above, the wells are used to supplement the supply from rivers, mountain springs or streams, and lakes, or are resorted to in the outskirts of towns to which the water from the latter has not yet been extended.

No. 2—By iron pipes, 5; by open ditches and iron pipes, 3; by iron and lead pipes, 1; by open ditch, 1; by wooden pipe, 1.

No. 3—One answers yes; one, yes, for a portion of the supply; eight say no. One of the latter excepting the possibility of contamination by vegetation growing and decaying at the source of supply.

No. 4—Yes, 1; yes, one for a portion of the supply; no, 13—two of these, alluding to the possibility of contamination by falling leaves and other vegetable substances, and one to cattle having access to the ditch in which the water is conveyed.

No. 6—Depth of wells from 5 to 20 feet in 4 localities; 20 to 40 feet in 6; 40 to 50 feet in 1; 100 to 120 feet in 1; 1,002 feet in 1; 12 to 100 feet in 1; 25 to 150 feet in 3; and 50 to 300 feet in 3. The deep wells are artesian, as at San José, San Bernardino, Stockton, Visalia, and Bakersfield. At San José, Dr. J. Bradford Cox states that nine of the artesian wells are owned by the San José Water Company, "the water being pumped from them into tanks by steam engines; these wells are from 50 to 300 feet deep." No statement of the number of artesian wells at San Bernardino is given. Their usual depth is stated by Dr. W. R. Fox to be 120 feet. The supply of water is abundant and of good quality, though somewhat hard, as shown by the soap test. The artesian well from which the city is mainly supplied, the depth of which is given as 1,002 feet, is located at Stockton. The water is considered to be of good quality. Other wells are from 18 to 100 feet in depth.

No. 7—Nine answer yes—one, excepting the water from surface wells; ten reply no, modified in two instances by the adjective *slight*.

No. 8—Question answered by one correspondent, who says "no, except by accident," and by two, who say "there is no sewerage."

No. 9—Twenty answer "good;" one, "fair;" one qualifies the answer by adding "partly;" twenty-one report "clear water, except during the rainy season;" fourteen say "tasteless;" four, "generally so;" one, "not entirely;" one, "except during a short time in summer, when it has the taste of sulphuretted hydrogen"—referring to lake water; three answer "no;" five report the water as being "hard;" two, "wells hard and springs soft;" two, "hard in wells and soft in ditches"—from mountain sources; one, "some hard and some soft"—referring to different sources of supply; four, "moderately hard;" one, "hard, but different in different wells;" one, "somewhat hard, but not *permanently* hard"—Q. C. Smith, Cloverdale; five, "soft."

No. 10—"No analysis," 22.

No. 11—"Yes," 22; "no," 1.

No. 12—Private, 18; mixed, 5.

Of the water facilities at San José, Dr. Cox states that "the supply is said to be abundant at its source, but, owing to the small size of pipe leading into the distributing reservoir, that furnished the city is not abundant. This defect will probably be soon remedied. It is supplied by the San José Water Company. The agent informed me that about 2,000,000 gallons per day were used. Much of this is used for irrigating private gardens, lawns, parks, and for watering the streets in summer. The Alameda is kept sprinkled during the greater part of the year. This extends from San José to Santa Clara, a distance of about four miles. Santa Clara, containing about 2,000 inhabitants, is also supplied by the same works."

Other sources of water for this city consist of three small lakes, and the Los Gatos Creek, in the Santa Cruz Mountains. About ten per cent. of the population use water from surface wells, the latter being suspected of contamination from proximity to privies and cess-pools.

Of the supply of water at Cloverdale, as furnished by the mountain springs, Dr. Smith states the "supposed" chemical constituents to be carbonate of magnesia and borate of magnesia and soda, with a trace of iron.

The only mountain towns heard from are Downieville, Sierra County; Placerville, El Dorado County; and Cedarville, Modoc County. The former is supplied altogether from water from mountain streams and a creek; it is said, by Dr. Jump, to be "uncontaminated, clear, tasteless, and soft."

Placerville derives its supply from springs, supplemented by wells from 5 to 30 feet deep. "Small mountain rivulets and wells about 20 to 30 feet deep afford water for Cedarville." That from the former reaches the town through irrigating ditches, where, in the opinion of Dr. Patterson, "it is contaminated in passing corrals and gardens. Cases of remittent fever, tending to typhoid, occur in families using water from ditches, and from wells into which those ditches may drain." He thinks there is good reason to believe that some of the wells are polluted by proximity to privies, cess-pools, or drains. "In several families," he adds, "remittent fever, terminating in typhoid, has attacked all or many of the members thereof; and, in every instance, I have been able to see possible contamination of the water supply. In some cases the attacks could be traced almost positively to impure water."

Of towns located on the Sacramento River, Colusa is the only one reported to obtain its supply mainly from this source, through the aid of private water-works, though, in portions of the town, wells, varying in depth from 15 to 70 feet, are used. The Secretary of the local Board of Health thinks there is good reason to suspect contamination of the latter. For reasons mentioned in a previous part of this paper, the river water ought to be less liable to pollution than lower down the Sacramento.

Red Bluff derives most of its water, for drinking purposes, from Antelope Creek, which rises in the foot-hills of the Sierra Nevada Mountains. The water is brought in in iron pipes. The County Surveyor informs me that a much better water might have been obtained by pumping from the river, which at that point is clear.

In Woodland, whose water supply is obtained from wells, shallow and deep, Dr. Ross informs me there is no drainage. Cess-pools and privies are universally used. None of these are water-tight, and the soil is of a character favorable to the percolation of their contents

into the private wells. He thinks there is reason to believe that thi sometimes occurs. The soil is alluvial, from 5 to 8 feet in depth then, a loose porous sand; then, gravel; then, blue clay, impervious to water; then, a hard-pan. The wells are commonly bored until the gravel is reached. They are often only a short distance from the cess-pool or privy. The principal supply of the town, however, is from deep wells containing good water.

The greater portion of the water used by the citizens of Marysville is supplied by two bored wells, one said to be 176 feet in depth and the other 226 feet—under the direction of a private company. The water is clear, tasteless, moderately soft, and of good quality. It is pumped into a reservoir and distributed by pipes. The supply is abundant for domestic purposes, including irrigation. The neighboring city—Yuba City—receives its supply from the same source. Only in the suburbs of Marysville, where private surface wells are used, have the evidences of contamination of the water supply been observed.

Dr. W. E. Hook furnishes the following to the questions concerning the water supply of Oakland:

No. 1—Oakland receives its water supply from wells and from an artificial lake.
No. 2—The water is conveyed from the lake to the city by means of an iron pipe.
No. 3—The lake is not liable to contamination by sewage but by substances washed into it during the winter season.
No. 4—The water is not liable to contamination between its source and the city.
No. 6—Usual depth of the wells about 40 feet.
No. 7—There are no reasons to suspect contamination of wells by proximity to privies, etc.
No. 8—The supply is not from rivers.
No. 9—The water supply is considered of good quality. It is not tasteless; it is soft; it is clear, except in winter.
No. 10—There has been no reliable analysis made.
No. 11—The water supply is quite abundant.
No. 12—Oakland is supplied with water by private enterprise.

THE WATER SUPPLY OF SACRAMENTO.

This being one of the principal cities, and the Capital of the State, justifies a closer inquiry into its water supply. This is especially called for in view of the frequent agitation of the subject, and the wide differences of opinion expressed.

In pursuance of a design to procure reliable analyses of the water supply of some of the principal cities of California, samples of the water of the Sacramento River were placed in the hands of a chemist, whose analysis is herewith given. The work was performed by Mr. Walter B. Jones, of Berkeley, a gentleman recommended by Professors Rising and Hilgard of the State University. The work was performed under the supervision of Professor Rising.

The sample of water marked No. 1 was taken, at a moderately low stage of the river, in September, directly from one of the supply pipes in the city; samples Nos. 2 and 3 were obtained by Professor Rising, the former near the junction of the Feather River with the Sacramento, and the other above Knight's Landing.

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In connection with the analysis, Mr. Jones has briefly submitted his conclusions as follows:

I.—THE SACRAMENTO WATER.

The samples of water were filtered as thoroughly as possible, through pure filter-paper, and the residue determined and analyzed qualitatively. The filtered water evaporated to dryness and the solid contents or residue after evaporation was subjected to careful quantitative investigation. The results of this investigation are given in Part I of the tabular report. The only way in which we can form an opinion as to the quality of the water from this portion of the analysis would be by the presence or absence of metallic poisons; none of these being found we may, after discussing the amount of solid matter per gallon, dismiss this portion of the analysis. Ten grains per gallon has been placed as a limit for a good soft water. In the case under consideration we find but 7.15 grains per gallon.

Let us now turn our attention to the special determinations of ammonia, albuminoid ammonia, nitric acid, upon which we may assume certain opinions in regard to the sanitary condition of the water.

Nitrates: "Presence or abundance of nitrates does not necessarily show defilement by means of sewage, and deficiency of nitrates does not show absence of defilement. And we do not look upon the presence of considerable quantities of nitrates in water as any bar to its domestic use." (Wanklyn & Chapman.) The amount of nitrates (calculated in terms of nitric acid) found does not differ materially in the three samples, and is but very slight in all of them.

Ammonia and albuminoid ammonia: The quantities found of each of these is very small. The tests were made with every possible precaution against the presence of free ammonia in the air of the laboratory, and may be relied on as being accurate as far as the quantity is concerned; but whether this ammonia is a correct standard by which to judge of the contamination of water seems to be an unsettled question. Certain it is that undue quantities of ammonia and albuminoid ammonia indicate the presence of decomposing animal organic matter; but can any one say with exactitude where the limit shall be which shall determine a water absolutely bad. Thorpe, one of the English Commissioners, says: "River waters may be said to contain on the average about 0.01 part in 100.000 parts of liquid, although this amount is subject to great variation. Bad well waters sometimes contain as much as 0.5 to 1 part in 100.000 parts." Wanklyn & Chapman (English investigators) say, all drinking waters may reasonably be required to be of such a degree of purity as not to yield more than 0.08 milligrammes of albuminoid ammonia per litre of water, while other authorities put the limit at still different figures. Now, in the case in hand, we may be assured of correctness in assuming the opinion that the amount of ammonia, etc., found to be present in the Sacramento water is too small to indicate contamination, and, aside from the suspended clay, etc., in the water, we can pronounce it as a good water for domestic purposes.

The amount of sediment in the Sacramento River water varies with the season. In the winter, or rainy season, and until late in the spring, it is in large quantity, giving the water a decidedly muddy appearance; at the time the sample for analysis was taken there was, probably, as little sediment as is ever of late years observed at this point. The water is supplied by the city authorities by means of two pumps: one, the Holly pump, having a capacity of 3,000,000 gallons per diem, and the other, known as the Stevens pump, designed by and made under the direction of A. J. Stevens, General Master Mechanic for the Central Pacific Railroad and its branches, possessing a capacity of 6,000,000 gallons. The former is run during the night, the latter during the day, when the demand for household purposes and irrigation is greater. At the present time, the supply is about 3,000,000 gallons per diem of twenty-four hours. It is a disputed question whether the water used in Sacramento does not come, to a great extent, from the American River, which empties into the Sacramento a short distance from the city. Probably a considerable portion does so reach us at all seasons; and it may become a question of serious importance, in view of the possible future contamination of that river. The latter, during low water, is narrow, shallow, and sluggish, and is less favorable for purifying such sewage as is likely to be discharged into it, or even rendering it innocuous by *dilution* than is the Sacramento River.

In view of these facts, and the many sources of contamination to

which both these rivers are, and doubtless will continue to be, liable the problem of a different water supply has for some time engaged the attention of many citizens.

Apart from the danger from contamination there is a natural sense or instinct which revolts against the drinking of muddy water, and which is commonly manifested by emphatic demonstrations of disgust by strangers coming to the city.

To remedy this, it has been proposed to sink a basin in or near the old bed of the river down to the gravelly bottom of the bed, and thus to procure pure water by percolation. It is claimed that an inexhaustible supply can be obtained, and that it will be clear, pure, and sparkling.

The advantages to be gained by a supply of clear water, if pure, are certainly such as to commend the project to the serious attention of the city authorities. At all events, the experiment should be tried upon a small scale, and the character and amount of water capable of being supplied ascertained.

Since writing the above, a partial test has been made by boring down to what is believed to be the old bed of the American River, with the view of determining the quality of the water rather than the extent of the supply. The following strata were penetrated in the order mentioned: Light colored river mud, six feet; blue mud, eight feet; quicksand, forty feet; gravel and coarse pebbles, three feet; total, fifty-seven feet, or, adding twelve feet, being the distance of the river bed at the point where the bore was commenced below the level of the natural banks, 69 feet. The water from the "blue mud" was offensive to both taste and smell; that, however, down in the "gravel and pebbles," was selected for analysis.

The following is the result of the analysis, as determined by Professor Henry G. Hanks:

The water contained a yellowish sediment, which settled upon being allowed to stand for a time undisturbed. This being mechanical, it was filtered off, and the analysis made from the filtered water. The water, rendered perfectly clear by filtration, still retained a pale straw color and slight peaty taste. In its natural state it seemed to be neutral, or only slightly alkaline; but on being concentrated by evaporation, gave a strong alkaline reaction. A careful microscopical examination revealed the fact that the water teemed with lower forms of life—animal and vegetable—peculiar to bad water, while none of the higher forms were found. Lime water gave a precipitate, showing that free carbonic acid was present. The total carbonic acid, present was found to be 15.73 parts in 100.000. A portion boiled down to one-half let fall a precipitate held in solution as bicarbonates. This precipitate was found to consist of lime, iron, and carbonic acid, with traces of magnesia. The filtrate contained lime, sodium, magnesia, iron, chlorine, and organic matter.

A sample was treated by Wanklyn & Chapman's method to estimate organic matter, which gave the following result: free ammonia, 0.250 parts in 100.000; albuminoid matter, estimated as ammonia, parts in 100.000, 0.130.

The hardness was estimated in another portion, which resulted as follows: total hardness, 16.43 parts of carbonate of lime in 100.000, or, 11.50 grains in a gallon. The water becomes remarkably soft on boiling, the permanent hardness being equivalent to 1.96 parts of carbonate of lime in 100.000, or 1.36 grains per gallon. In making the soap test no curdy precipitate, indicating the presence of considerable quantities of magnesia, was produced.

The total solids in the water were estimated and found to be—parts in 100.000, 28.67; grains in a wine gallon, 16.119, and grains in an imperial gallon, 20.069.

A portion of the water was tested for chlorine, and the quantity determined. It was found to be—parts in 100.000, 1.06.

My examination of this water shows it to be decidedly bad, and unfit for use as an article of food in its present state; yet it is not so bad as it would appear from the analysis, for it is well known that there are mineral springs in California, the waters of which contain ammoniacal salts, and which naturally find their way into the rivers. This, in my opinion, accounts for the large amount of ammonia in the water you sent me; but there is no doubt as to the unusual quantity of albuminoid matter held in solution and the living organic matter present being highly objectionable.

While the water is unfit for domestic use, for manufacturing purposes and for use in steam

boilers it is well adapted, being free from sulphate of lime and other substances having a tendency to deposit an incrustation; although, if highly concentrated, it would be likely to foam in steam boilers.

[SEAL.] HENRY G. HANKS.

It is very evident from the above, therefore, that if the City of Sacramento is to seek a different water supply, it must seek it in a different direction than that proposed.

Comparing the results with those obtained from an analysis of the water of the Sacramento River, we find that in the well water there is thirty times as much free ammonia, twenty-two times as much albuminoid ammonia, three times as much chlorine, and two and a quarter times as much solid matter, as in that from the river. Yet, to the taste the water seems to be quite as good as that from many of the wells used in other localities.

The natural sources of the water supply for a large portion of the State are well shown in the map accompanying the paper by Dr. Stout, in the Appendix. The project of supplying San Francisco, and, en route, the Cities of Sacramento, Marysville, Stockton, and, perhaps, some others, from Lake Tahoe, is one of considerable magnitude, but presents no difficulties which engineering skill cannot easily surmount. The water supply would be abundant and the advantages resulting, in a sanitary as well as domestic aspect, far beyond any that can be estimated by mere pecuniary considerations. It can scarcely be doubted that the lakes and streams of the Sierra Nevada, while affording for all time a retreat and source of enjoyment to the worn and weary of city life and pursuits, will yet be called upon to supply the blessings of pure water to every available portion of the State.

WATER OF LOS ANGELES.

The water supply of Los Angeles is derived from two sources—one by the city, and the other by a private company. For the former, the water is taken from the Los Angeles River, conveyed by a ditch into a reservoir about five miles from the city, and thence in pipes. It supplies, mainly, the lower portions of the city. The other is procured from a marsh or *cienega*, as it is there called, an excavation having been made into which the water rises by filtration or percolation.

By the courtesy of the Health Officer, Dr. Walter Lindley, a sample of the city or river water was sent for analysis. The result is given below by Mr. Jones:

II.—LOS ANGELES WATER.

As we have seen, the investigators on this subject of the ammonia determinations, as a measure of the organic matter in state of decomposition, disagree. The question of the reliability of this alone as a measure of the impurity of the water is an open one. The microscope alone is the conclusive test. If bacteria are found in a fresh sample of water taken from beneath the surface and carefully excluded from the air we may infer the presence of decomposing organic matter, as these bacteria feed on such matter, then our ammonia determination is of value, because we know the origin of its presence. In the Los Angeles water we find a quantity of ammonia and albuminoid ammonia sufficient to class the water as suspicious, according to Fox and Wanklyn & Chapman. The chlorine present being in combination as a salt has no effect. The nitrates indicate but very little, and without a microscopic examination we should not be willing to class the water as absolutely bad and unhealthy. The water is certainly not a first class water, as is indicated by the large amount of solid matter per gallon. I shall not hesitate, however, in saying that I believe the water to be fit for drinking purposes, and free from sewage or decomposing organic contamination in quantities to render it dangerous, as far as my analysis indicates. If, however, a careful microscopical examination is made of a fresh and properly collected sample at Los Angeles, and bacteria are found in any number, then there may be grounds for suspicion; until then the mere chemical test is not enough to put it under the ban of condemnation.

In addition to what has been said by Mr. Jones in regard to the analysis of the water of the Sacramento and Los Angeles Rivers, it may aid in the estimation of the results obtained to bear in mind what is supposed to be the true significance of the substances found. While chlorine, ammonia, albuminoid ammonia, and the nitrates and nitrites are usually considered to be the measure of the impurity or sewage contamination of a water, they are probably so only under certain circumstances. With regard to chlorine, for example, good natural water may be said to contain from .7 to 1.2 grains per gallon. An excess may or may not indicate sewage pollution. Much depends upon the amount of organic matter and nitrates present, and the mineral constitution of the soil. When an excess of chlorine is accompanied by an excess of ammonia and albuminoid ammonia, it becomes an important consideration.

The same may be said of the nitrates and the nitrites. Considered alone, their significance as to the present pollution of the water may be slight; yet they indicate the danger of pollution, or, according to English authorities, the one of oxidizing processes completed, the other of oxidizing processes going on. But, as has been remarked by Fox (Sanitary Examination of Water, Air, and Food), "we know not how soon the soil" (speaking of well water) "may become overdone with filth, and will, at first imperfectly, and at length finally, cease to cleanse by filtration the polluted water, when the organic matters will themselves enter the well."

Again the same author cautions us against pronouncing judgment upon a water from the examination of albuminoid ammonia alone, "a practice," he says, "which has thrown great discredit upon the chemistry of the subject."

A water, with or without an excess of free ammonia, which displays a larger amount of albuminoid ammonia than .15 milligramme per liter, should always be condemned if there is an excess of nitrogen as nitrates and nitrites (in non-chalky districts) and an excess over the average of the district of chlorides. If, with the above-mentioned excess of organic matter, the nitrates, nitrites, and chlorides should be insignificant in quantity, we should not form so unfavorable an opinion of the water, but would suspect the organic matter to be of vegetable origin—a view that would be strengthened or rebutted by other evidence such as that derived from a microscopical examination of the deposit from the water, etc.

The following extracts may serve as a guide in the estimation of the analyses given above:

If, indeed, the albuminoid ammonia amounts to .02 or less than .05 milligramme per litre, the water belongs to the class of very pure water. When the albuminoid ammonia amounts to

.05 then the proportion of free ammonia becomes an element in the calculation; and I should be inclined to regard with some suspicion a water yielding a considerable quantity of free ammonia along with .05 parts of albuminoid ammonia. Free ammonia, however, being absent, or very small, a water should not be condemned unless the albuminoid ammonia reaches something like .10 per million. Albuminoid ammonia above .10 per million begins to be a very suspicious sign; and over .15 ought to condemn a water absolutely.

A good water for drinking purposes should not contain more than .01 or .02 milligramme of free ammonia, and .08 milligramme of albuminoid ammonia per litre.

A water which possesses the following amounts of the two ammonias is classed amongst the suspicious waters. I have frequently noticed such waters as belonging to shallow wells surrounded by soil on which soapsuds, etc., are sometimes thrown. Free ammonia .01 to .02 milligramme per litre, albuminoid ammonia .12 milligramme per litre. The suspicion of contamination is strengthened if the chlorides (in districts where these salts do not abound) and nitrates or nitrites (in non-chalky districts) are in excess.

SEWERAGE.

Intimately connected with the water supply of cities and towns is their sewerage. Without an abundant supply of water no system of sewerage can be effective, and, under certain circumstances, the possession of a supply of water necessitates the construction of drains and sewers. They are to some extent mutually dependent upon each other.

Having briefly considered the water supply of some of the cities and towns of California, as made known by the correspondents of the Board of Health, it has been deemed proper, therefore, to pursue a somewhat similar course in regard to their sewerage, and to review the present condition of the State, so far as the sources of information can be made available in this important respect. It is to be regretted that, of those to whom questions touching this subject have been sent, so few have been found to give the needed information. Out of about sixty blanks sent out, but twenty-three have been returned filled up. They cover, however, almost all sections of the State, and will serve to show, in a general way, the adaptation of different localities to the proper disposal of sewage, and the extent to which the subject has commanded attention. It will be seen, in the brief review of which the limits of this report will admit, that many of the localities are poorly adapted by their topography for the construction of a perfect system of sewerage, and the lamentable fact is revealed that in many, in all sections of the State, there is an absence of a spirit of enterprise to overcome obstacles, and an apparent want of appreciation of the real importance of the subject. On the other hand there is discovered, from some others, the gratifying evidence that the apathy which has so long prevailed has given way to efforts at reform. It cannot be too strongly impressed upon municipal authorities, everywhere, that reform in this respect means improved healthfulness, and that healthfulness is one of the best promoters of prosperity.

As just stated, many of our interior towns are poorly located for the adoption of any system of sewerage, however imperfect. Situated upon a level plane, with surface water often within a few feet below, without natural outfall, without an abundant and constant water supply, the difficulties are not easily overcome; or, if near the banks of a river whose water is used for domestic purposes, the temptation to the pollution of the stream is often too strong to be resisted. The evils are thus transferred from one's own door to that of the innocent and unsuspecting neighbor. Of the reports, twenty-three in number,

received from correspondents, it is ascertained that a regular or i any way complete sewerage system had been adopted in one, but tha efforts had been made to accomplish this result in seven. Of thes the outfall of six was wholly into water courses, and partly so in one the main portion being into a ditch near town, where it is used fo irrigation. In three other localities sewerage facilities have beer arranged, answering a temporary purpose—one discharging into the ocean, one into an inland bay, and one into ponds. In one the sewage is utilized for irrigation; in one it is drained into a creek in the center of the town. In two the system adopted is said to be efficient; in one it is partly so; in one it is so for about one-fifth of the area of the city; in one for about four months in a year. In seven the location of the town is said to be favorable to the construction of sewers. In five there is no restriction as to the kind of sewage allowed to enter the sewers—at least so far as refers to hotels and public buildings. Of the water courses said to receive sewage, four are not used for domestic purposes either directly or after junction with other streams; one unites with another stream after a course of twelve miles, which is, in some parts of its course, so used; and one after about forty miles. The materials used in the construction of sewers are: wholly redwood lumber, two; of lumber, bricks, and cement, two; of bricks and glazed iron-stone ware, one; of bricks, stone-ware, and cement pipe, one. Facilities for flushing are said to be ample in four; imperfect in one; and in one the fact is not stated. Ventilation is good in one; poor, or altogether wanting, in three; in two, not mentioned. Cess-pools are said to be used in sixteen; partly used in one; from the other towns no information is given. The cess-pools are said to be water-tight in one; not so in ten; information wanting in all the rest.

The drains leading to sewers or cess-pools are trapped and ventilated, in two; trapped but not ventilated, in two; neither, in eight; not stated, in ten. In one (Woodland, in the Sacramento Valley), where cess-pools are used altogether, Dr. Ross informs me that a few only of the drains leading thereto are trapped at their connections with the houses. It is the common custom to ventilate the cess-pool by means of a wooden pipe rising a number of feet from the center. Of the privies, it is said that many of them are ventilated by the Eastmond and Cottier plan.

Of the localities from which the above data have been received, three are in the mountains—all favorable to drainage; on or near the coast, four—three favorable to drainage; in what are known as the coast valleys, six—five being favorable; and ten in the interior valleys—seven being said to be favorably located—in one of these *because of its proximity to the Sacramento River.*

Were all the localities from which responses have been expected embraced in this report, the interior valleys would not stand in quite so favorable a light, many being such as were described just now. The facts collected, as a whole, show an urgent need of improvement. It is by no means a flattering commentary upon the enterprise of our people that, of twenty-three towns and cities, some of them large and prosperous, the centers of extensive commercial or agricultural interests, not a single one should as yet have completed a system of sewerage, and only six commenced the work in earnest. Yet the correspondents tell us that of these twenty-three towns, nineteen are favorably located.

Several causes have concurred in bringing about this result; one, a prejudice against what are considered, by some, modern innovations against long established habits and a consequent inappreciation of the benefits to be derived; one, inattention and procrastination in consequence of the engrossing cares of public and private duties among those having power to act, the evil itself being fully recognized; another, the expense attending such works and, in some instances, a defect in the law which fails to confer power to expend money and increase taxation for such a purpose without a vote of the people in its favor; and lastly, in a few cases, the absence, as yet, of any severe or terribly alarming epidemic, manifestly due to the neglect of this duty, desolating homes and awakening the voices of mourning among the people. One of these obstacles, having its origin in prejudice and ignorance of sanitary laws, it is a prominent object of the State Board of Health to remove. Some of the evils of neglect will be alluded to in different parts of this biennial report; but it seems proper to refer to them, and to the advantages arising from efficient sewerage systems, briefly in this place. It ought to be sufficient to call attention to the splendid results obtained in England by the adoption of the sewerage system; the diminution of mortality wherever it has been introduced; the reduction of the death rate of twenty cities in England since the completion of sanitary works—a reduction equal to 16 per cent.—and the further fact of the abatement of mortality in these same towns by one single disease—typhoid fever—of 47.7 per cent.; to the City of London, which, with a climate much less salubrious than Brussels or Paris, exhibits, by reason of its sanitary works, a conspicuously lower rate of mortality; to St. Louis, in this country, raised from one of the lowest to almost the first in salubrity among American cities. There is no theory about these things; they rest upon the impregnable basis of facts, and they have been the result of the sanitary measures of which the introduction of a sewerage system is one of the leading features.

Among the diseases which sustain a more or less close relation to sewers, and whose death rate has been sensibly modified by good sewerage, may be mentioned typhoid fever, diarrhœa, cholera, possibly diphtheria, and consumption. Besides the evidence as to the first of these already given, based upon the statistics of English towns, the opinions of many of the leading sanitarians of the day might be cited, all tending to substantiate the same fact. The medical officers of Great Britain, whose long observation of the effect of sanitary measures entitles their opinions to great weight, are well convinced of the existence of this relation, and it is only recently that Professor Alonzo Clark, of New York, has added to the list of essential fevers one under the name of "cess-pool fever," which, though not precisely typhoid, has many characters in common with it.

The history of epidemic cholera affords the most abundant evidence not only of the effect of insanitary conditions in promoting its spread and increasing its fatality, but also of the salutary influence of an effective sewerage system in arresting its progress and mitigating its violence. This has been shown to be due not alone to the means provided for conveying away materials in every sense offensive, but to the protection such a system affords against contamination of the water supply. Pure air becomes then intimately associated with pure water in the prevention of one of the severest

maladies of which the present century has been the witness. Dr. Parkes, speaking of the "influence the construction of sewers has had on the death rate of towns," quotes the opinion of Dr. Buchanan, who considers, in view of the effects observed, that cholera epidemics have been rendered "practically harmless. The immense significance of this statement," he adds, "will be at once appreciated."

With respect to the relation of consumption to works like those now under consideration, opinions are not fully settled; but, as it has been well demonstrated that there is an intimate relation between soil dampness and this disease, and as drainage and, consequently, the improvement of the soil in this respect is one of the essential parts of a complete sewerage system, it is reasonable to infer that the influence would be marked. This has, in fact, been shown to be the case by the statistics of twelve towns, selected by Baldwin Latham from the reports of the medical officers to the Privy Council—their aggregate population being 304,859. Thus, in these twelve towns, there was a mean reduction in the per cent. of consumption, as the result of sanitary works, of 29.9.

Dr. Buchanan's report, "Upon the Results of Works for Promoting Public Health," shows that the general death rate of Newport, in South Wales, was reduced 23 per cent., while the ailments known as phthisis were reduced 32 per cent. At Cardiff the general death rate was reduced 24 per cent., and the death rate from phthisis 17 per cent. At Salisbury the general death rate was reduced 9 per cent., and that due to phthisis 49 per cent. (Denton.)

The relation of defective sewerage to diphtheria has been already spoken of in another part of this report.

Perhaps sufficient has been said to convince the most sceptical that a good and efficient sewerage system is not without positive advantage in a sanitary point of view, and worthy of some effort for its attainment. Of course, the adoption of the sewerage system presupposes the existence of an outfall, and that this outfall is so situated as not to involve the pollution of the streams, or the intermingling of unpurified sewage therewith. To prevent this has long been a subject of study and investigation among sanitary engineers, and hence the disposal of sewage constitutes one of the principal difficulties. In towns located near the beds of rivers these will ultimately become the receptacle of the sewage, and various methods have been proposed of depriving it of its offensive and hurtful properties, and of rendering the water which receives it fit for domestic consumption. The history of the efforts to purify the Thames and other rivers of Europe is full of interest, and the result has been presented in striking contrast with other rivers which have been permitted to receive unpurified sewage.

It will be impossible in this report to enter upon a minutely detailed account of the several processes which have been proposed for the neutralization of the deleterious properties of sewage. None of them are perfect; complete purification is not aimed at, because impracticable; but simply such an extent as will reduce the organic matters held in solution below what experience has shown to be hurtful.

To glance, then, at the methods by which this has been accomplished, we may mention:

1. Purification by irrigation, the rationale of the process being

that through the action of vegetation in assimilating and utilizing the organic matters in the sewage, and that of the soil in its role as a filter and oxidizer, it is rendered sufficiently pure to be admitted to the stream—supplemented as the process will there be by dilution and by the oxidizing action of the water. The water passes through the soil and thence to a water-course by means of drains five or six feet deep. The arrangements for the purpose will depend upon circumstances—upon the topography of the locality, and the possible necessity of elevating the sewage upon the land by pumping; upon the character of the sewage, and the nature of the soil. The quantity of sewage to be applied must be regulated by the capacity of the soil to absorb without overflow, and by the demands of vegetation. The irrigating ground, which should be loamy, requires preparation both upon the surface and underneath; the former must have a slope to favor the proper covering of the soil and to prevent absorption. Where the contents of water-closets are permitted to enter the sewers, it is customary to allow the sewage to pass through a strainer so as to separate the coarser particles before it is permitted to flow upon the land. The details of the process cannot be fully described here. For their successful operation engineering skill is required. It need only be added that, in the opinion of most of those who have given the subject their attention, the results obtained are better than those from any other plan of sewage purification. Though sewage thus applied to farms is recognized as a good fertilizer, it is questionable whether it can ever be brought into use as a profitable pecuniary investment.

A method of irrigation well adapted for use on a small scale, as for farm houses and where no sufficient outfall is available, is that adopted by G. E. Waring for his own use, and which has since been recommended by others. Only liquid sewage is applicable to the purpose, and hence the contents of water-closets are excluded. The sewage from the bath-room and kitchen is received just outside of the house, into a gully or grease trap, tightly cemented, and ventilated by a pipe extending above the roof of the house. The solid matters fall to the bottom of the trap, the grease congeals and floats on the surface of the liquid, while the latter is discharged through a siphon into a drain leading to the ground to be irrigated—the discharge pipe being made of the glazed or vitrified stone-ware. This connects with a system of open-jointed or perforated drain tiles, consisting, as Mr. Waring has arranged them for himself, "of one main fifty feet long, and eight lateral drains six feet apart, and each about twenty feet long. These drains underlie a part of the lawn, and are only about ten inches below the surface." "During the whole growing season," he says, "their course is very distinctly marked by the rank growth of grass over and near to them. The difference of growth in their immediate vicinity being so great that were the work to be done over again I should place the lines but three feet apart." The slope of the ground is not more than fifteen inches between the extreme ends of the system.

But circumstances are not always favorable to sewage irrigation, or it may not be possible with large cities to obtain land suitable for the purpose, at a reasonable distance, or at a cost that will justify the outlay. For these and other controlling reasons, the method of purification by precipitation has been proposed.

Various conditions attach to this process; the sewage must be strained to remove the coarser, insoluble contents, as well as foreign bodies, which may have found their way into it. It is then to be treated by chemical agents, while at the same time an opportunity is given for subsidence. The best chemicals are those which deodorize and disinfect the sewage while they occasion precipitation. Means are also to be provided for the disposal of the precipitate.

As precipitating agents the salts of alumina, alone or variously combined, have been tried; iron salts, as the sulphate or perchloride; lime, one of the first substances used and preferred on account of its cheapness; the salts of magnesia, and various combinations of these several substances, preference being usually given to those possessing the greatest purifying powers not only, but which least affect the manurial value of the precipitate or *sludge*. The common plan has been to dry this sludge, and thus dispose of it as manure. Several other uses have been made of it with the view of defraying the expenses of the process.

The result of precipitation, however, by itself, has proved unsatisfactory. In the opinion of the majority of those best capable of judging, "the solution of the sewage difficulty will, without doubt, be found, in a large number of cases, in a combination of precipitation with irrigation; the former, for the purpose of deodorizing the sewage and removing the solid parts, and the latter, for the purpose of obtaining, where necessary, a high standard of purity in the effluent water." (Robinson and Melliss: The Purification of Water-carried Sewage.) Other processes, as filtration through a porous soil, through charcoal, coke, spongy iron, etc., have been attempted, but with only partial success. They have been, in a sanitary point of view, for the most part failures. But it sometimes happens, and in some of the small towns of California it is unquestionably true, that by reason of this difficulty of obtaining a supply of water and the expense attending the water-carriage system for the disposal of sewage, all the methods alluded to are impracticable. The adoption of some other plan, therefore, becomes not a question of choice but of necessity.

Leaving out of view the question of cess-pools and privies, the evils attendant upon which it is the object of all sanitarians to avoid, probably the best substitute for the sewage system may be found in one of the methods adopted for the dry removal of the excreta. Of these, the dry earth system is the best known, and probably the best in practice. The principle is the immediate deodorization of the excreta by dry earth, and their removal, from time to time, as fertilizers. Practically, its operation is simple—a sufficient quantity of the earth being caused, by a proper mechanical arrangement of the closet, to cover the fecal discharge and absorb the urine.

Disinfection is at once effected, all odor is removed, and the receptacle, which usually consists of a pail or tub, may be allowed to remain until sufficiently full to require removal. The requisites are that the earth shall be dry; that it be of good quality—containing more or less clay, or consist of marl or vegetable humus; that it be pulverized and sifted from gravel; that the supply be ample. It is estimated that one to one and one-half pounds of *dry* earth will be ample for each dejection. The plan may be adopted for indoor use as a substitute for the water-closet, or outside, in lieu of the ordinary privy, the

some care being taken to secure the timely removal of the receptacle. No liquids should be allowed to mingle with the mixture, the object being to keep it sufficiently dry to prevent offensive decomposition. Hence, other means must be provided for the disposal of the refuse and waste water from the house and kitchen. For the latter, no better arrangement can be made than that spoken of above, as used for underground irrigation by Mr. Waring, of Newport, Rhode Island.

The used soil removed from these closets constitutes a valuable fertilizer, which, according to the best authorities, is entirely inoffensive.

The plan, though simple and easy enough of application to private families, possesses some disadvantages when adopted by towns. It is beyond regular and perfect control, and the result liable to be spoiled by the careless admission of water; the removal of the used soil at proper intervals, is, if not neglected, expensive; the procurement of earth in proper quantity is likely to be difficult. Take for example a town containing two hundred houses, each provided with an earth closet; allowing four persons to each house, and one and a half pounds of dry earth daily to each person, there would be required 1,200 pounds daily, or 438,000 pounds per annum, equal to 219 tons. It is true that the used soil may be dried, pulverized, and used again, and that the process may be repeated almost indefinitely; but even with this advantage, the difficulties of obtaining earth of a proper kind, of drying and sifting it, and of delivery and final removal, are such that few of our country towns would feel disposed to encounter them. For private families—for isolated dwellings—when the water supply is limited and the facilities for sewers inadequate, the dry earth system cannot be too strongly recommended, at least as against cess-pools and privies. Other substances have been used with the same view, as ashes, and even the dust and sweepings of houses; but while they are less effectual as disinfectants than dry earth, they result in materials much less reliable as fertilizers. That all of them may prove successful in remedying what is universally acknowledged to be a nuisance, however, by disinfecting and deodorizing and effecting the removal from one's door of materials whose presence is always considered objectionable and disgusting, must be admitted. The object is one which, considered as a sanitary measure, it is worth some trouble and some expenditure of money to consummate.

It seems, therefore, in view of all that has been said, that the difficulties in the way of any of these enterprises are so great that it would be almost impossible for some of our valley towns, as was remarked in the beginning of this report, to adopt any of them, and that cess-pools, notwithstanding the very strong objections which have been urged against them by sanitarians and by all who have studied the means best adapted to render our homes healthful, must perforce be resorted to. But cess-pools mean something more than the shallow holes in the ground, or the loosely constructed excavations which are often dignified by such a title. Allusion has already been made to this subject in the consideration of the water supply, and to the danger of contamination of the latter by percolation through the soil into shallow wells. Instances might be multiplied where such contamination has been demonstrated, not only by the breaking out of disease, but by chemical analysis; nor has any precise limit been fixed beyond which, under favorable circum-

stances, such percolation may not extend. A remarkable instance is recorded in which it was demonstrated that typhoid fever was communicated a distance of a mile or more by an underground communication of an infected stream with the water supply of the village of Lausen, Switzerland. From the 7th of August, 1872, to the end of October, 130 cases occurred. All who drank the water became ill; and of those who drank other water, none. That this water, in its passage from the source of infection to the contaminated well was subjected to filtration was demonstrated by the fact of one hundred weight of flour, which was thrown in at the source, having disappeared by filtration, while salt being added was soon detected, by analysis, in the well. Many equally striking instances might be given showing the possibility of water contamination by privies and cess-pools, as well as from the waste water thrown out upon the soil from the house to spread whither it will, or to percolate through the soil. A single cess-pool in connection with an isolated dwelling, properly constructed, perfectly cemented, and sufficiently small to make frequent cleansing absolutely necessary, and not too near the well, might, doubtless, be exempt from the objections urged against them in cities. It is the exception, in fact, to find them water-tight, and the only protection to the wells on the premises is in the oxidizing power of the soil; a safe protection for a time, but not inexhaustible. In large cities, with small lots, and each lot provided with a cess-pool uncemented, and leaky, and a privy equally liable to discharge its liquid contents into the soil, and withal a well, the only source of water supply, and this condition of things remaining unchanged for years, is it surprising that the soil should ultimately become supersaturated with the products of animal and vegetable decomposition, its oxidizing power lost, and itself the source of contamination, not only of the wells but of the atmosphere about it.

"The more insidious process," says Waring, "is that of the gradual fouling of the semi-porous earth lying between the source of the impurity and the drinking-water well. In such cases the exudation is quite or nearly constant; there is little opportunity for the air to restore the filtering power of the soil, and it becomes saturated with impurity, inch by inch, until, perhaps after a month, or perhaps after several years, the saturation reaches the well; then every drop oozing from this source carries with it its atom of filth."

It is not without reason that cess-pools and privies should have been universally condemned by those who have given the subject attentive examination.

Making the cess-pool water tight modifies the evil but does not remedy it, for there still exists the danger of the passage of foul air from the cess-pool into the dwelling through the drains. But there still remains the privy, with its foul, reeking contents, endangering both air and water, and which even close attention to ventilation and disinfection cannot wholly relieve. These things, however, when presented as the only alternative, should at least be made endurable by the best means which can now be suggested—by making both cess-pool and privy pits so small as to require frequent removal of their contents, and by making the former securely water tight, and disconnecting them from the interior of the dwelling by the grease or gully trap previously alluded to. One of these, completely dis-

connecting the house from the drain leading to the city sewer, which the writer has had in use for some time, has done excellent service. The vaults of privies should be thoroughly ventilated and frequently disinfected; they should also be emptied once or twice a year by the odorless excavating apparatus. For the benefit of those to whom this valuable apparatus is unknown, an explauatory cut is inserted. Among the disinfectants, sulphate of iron (copperas) is one of the cheapest and best—about five to eight pounds dissolved in a bucketful of water being thrown in once a week.

In the few towns or cities of California in which correspondents report sewers to have been commenced or completed, the materials used in their construction are reported to be "redwood lumber;" "of the latter and bricks and cement pipe;" "of brick and glazed ironstone ware."

Of the woods obtainable in California, the redwood is unquestionably the best, being durable and, if of good quality, less liable to decay than any other. For temporary use, even in damp soil, it has answered an excellent purpose. When regard is had to permanency, as in the construction of a definite sewerage system, one of the others named will be found less liable to get out of order, and the cheapest in the end. No fixed rules, however, can be laid down for guidance in sewer construction. Much must depend upon the topography of the place, the inclination obtainable, the outfall, etc. These things can only be determined by a competent engineer.

In general, it has been customary to make the main sewers of brick, while the side branches are of glazed stone-ware or of cement. Except for the very largest structures, the stone-ware properly glazed and burned, or the cement pipes, well made of reliable cement, capable of withstanding proper chemical and mechanical tests, should be used. In speaking of this subject, Latham (Sanitary Engineering) states that his experience "with the construction of concrete sewers shows how easily such work can be scamped by an unscrupulous contractor. It is, therefore, absolutely necessary in the construction of concrete sewers that no person should be engaged who will not strictly adhere to and implicitly carry out the orders of the engineer." He adds: "The author has witnessed failures in concrete work, apparently of the best description." Either of these kinds of pipes are made of almost any desired size, from three inches to twenty-four inches in diameter, the latter being sufficiently capacious for almost any purpose. The advantages over other materials are durability, strength to sustain the superincumbent weight of earth when deeply laid, smoothness of internal surface, thereby offering the least possible resistance to the flow of sewage through them, imperviousness, convenience of size for almost any sewer, and, as compared with brick, cheapness.

The questions relating to ventilation of sewers and trapping of the house connections will be sufficiently considered in that subdivision of the subject which relates to the "Hygiene of the Dwelling."

For one of the best treatises upon the subject of sewers and the

proportion of their size, form, and inclination to the volume they to convey in order to be self-cleansing, and all other points in re to this difficult subject, the inquirer is referred to the last editi the elaborate work of Baldwin Latham on "Sanitary Engineer

The sewerage of the larger cities of California deserves more the cursory notice which has been given it. Of these cities, info tion of a somewhat definite character has been received from S mento, Los Angeles, Marysville, and Oakland. The former, fro position in a somewhat low and level plain at the junction o American and Sacramento Rivers, has had many difficulties to tend against in devising and adopting a suitable sewerage sys Some of them are not yet overcome, but through the contin efforts of the City Board of Health, sustained by the Board of T ees, a general plan has at length been agreed upon, which, tho involving considerable expense, besides being far from perfect, it is believed, prove sufficient for some years. A pretty correct of this system may be obtained from the accompanying "cha which has been prepared for this report by Mr. Bassett, the pres accomplished City Engineer. It will be observed that the p embraces a sewer along every alternate street running from nort south, with side drains connecting therewith through the alleys either side. These sewers have a fall of about six inches for ea block from the north levee to R Street, where their contents unite the foot of Sixth Street, and empty into what is called the "drain canal"—an open ditch about five feet wide at the bottom and feet deep—designed ultimately to convey the sewage and drain water to Snodgrass Slough, a distance of about thirty miles. The lowing general description of the work, as now completed or und contemplation, will serve more fully to explain it:

The remarks of the engineer upon the subject of subsoil drainage and its importance as a sanitary measure deserve the attention of the authorities. Soil dampness is one of the evils inseparable from towns situated like this, upon an almost level plain, at the junction of two rivers liable to overflow, within whose leveed banks it sits like a basin, lower than the surrounding waters from which it receives the sipage. In consequence of this, cellars are rendered unsafe, low lots are often covered with water, and the soil is more or less cold and damp. The perfection of a system of subsoil drainage here would be of incalculable benefit. It may be seriously questioned, however, whether the policy of adopting a system of irrigation for the land south of the city would prove expedient as a sanitary measure or profitable as an investment. The objections arising from the first of these considerations might be obviated, land being abundant for intermittent irrigation, by works properly constructed for the purification of the sewage. Perhaps, when the population of the city has largely increased, some such plan may become a necessity.

Engineer Bassett says:

The sewerage system of Sacramento is still incomplete, although a plan has, in great part, been worked out and adopted. The system has for its outlet the low country to the south of Sacramento, and ultimately, when the drainage canal is completed, will connect with tide water via Snodgrass Slough.

From the bottom of the sewers at Sixth and R Streets to low tide in the Bay of San Francisco there is a fall of fourteen feet. The distance from Sacramento to the farthest point inland on the line of the canal, where the influence of the tide is felt, is between 25 and 30 miles.

A short distance below the Riverside road, and about one-half mile south of Y Street, the drainage canal is divided into two branches, the westerly branch passing to the west of Cemetery Hill to Sixth Street, and thence up Sixth Street to R Street, where the city sewers at present unite and discharge; this branch drains that portion of the city to the west of Thirteenth Street. The easterly branch passes to the east of Cemeterey Hill, and enters the city at Sixteenth and Y Streets, and passes under the levee on R Street at Eighteenth; thence through various streets to East Park, at Thirty-first and G Streets. This branch is intended to drain that portion of the city from Thirteenth to Thirty-first, and through it is discharged the rain and sipage water coming from the country to the east of the city, and which, during a wet winter or high water in the American River, is very considerable in quantity, and, before the cutting of the Burns Slough ditch, caused quite a considerable portion of the city and the country to the east along Burns Slough, to be covered with stagnant water until late in the season, or until evaporated by the hot sun in May or June.

As yet no connections with sewers have been made with the Burns Slough ditch; but when sewers are constructed east of Thirteenth Street they will have to be discharged into it, for the reason that sewers running easterly from Sixth and R, with the necessary rise per block, are too high for the street grades after passing Thirteenth Street.

On the low grade portion of the city, the tops of the sewers are placed from two to three feet below the grade of the streets, and the bottoms of the sewers from three to five feet below the grade of the streets.

Above R Street, both at Sixth Street and Seventeenth Street, the plan adopted gives a main sewer to every odd-numbered street, from which there is to be a branch at each alley into which the sewerage from the adjoining property is admitted. The rain or other water from the streets is admitted into the main or alley sewers through cess-pools covered with gratings and placed in the gutters as occasion demands.

At least once in each block on the line of a sewer a man-hole is left, which, where pipe sewers are laid, also serves for a cess-pool by extending it for three or more feet below the bottom of the sewer. These cess-pools are put in for the purpose of catching the heavier matter, as sand, etc., carried along by the sewerage, and which drops into these cess-pools and is taken out, thus preventing it from being deposited in the sewers and eventually choking them. These cess-pools are put in wherever there is a change in the direction of a sewer or at the junction of two or more sewers, and in all cases wherever an alley sewer connects with a main sewer, thus permitting the heavier matter brought by the alley sewers to be deposited in the cess-pools at its entrance into the main sewer.

At the head of every branch sewer an opening is left for flushing. Flushing is accomplished by turning one or more streams into the sewer through the openings left for flushing, from the hydrants which connect with the water mains. The main sewers are flushed by turning in several hydrant streams near the upper part of the sewer. This flushing is performed once or twice each month, according to the situation of the sewer and the nature of the sewage flowing through it.

The sewerage system of Sacramento, so far as it is extended, in great part accomplishes t purposes: It carries away (1) the surface water from the high grade portion of the city, an portion of the low grade, and (2) the sewerage. A third object, and a very important one the health of a city, it entirely fails to accomplish: that is, the drainage of the subsoil. Fr soon after the rise of the water in the rivers from the winter rains until they fall again in M or June, the ground at from two to four feet under the surface is completely saturated w water. In many places it even rises to the surface, and often stands to a depth of seve inches. This is because the sewers are at some points higher than the points to be drained a are made water tight, thus admitting no water except at points specially fixed for that purpo This is a necessity with sewers intended for conveying away the sewerage of towns, which co tains, as it does, so much filth; otherwise the sewerage would poison the soil and be of itself evil to be avoided if possible.

The cause of such a large amount of water in the subsoil is, as nearly every resident of Sa ramento is aware, sipage from the Sacramento and American Rivers. These streams mainta a hight of from one to ten or more feet above the general level of the surface of the ground the city for a greater or less length of time during each winter and spring.

The hight of the sipage water in the ground, in the different parts of the city, varies accor ing to the distance from the rivers, being higher in the northern and western parts of the ci and lower in the southern parts. This difference is greater than might be imagined—the diffe ence between Sixth and R and anywhere along B Street being frequently so great as twel feet.

Now, with this difference in the subsoil water from B to R Streets, the question very natural arises, what is to prevent a large portion of it from being drained off if the proper subsoil drai were constructed. Thousands of dollars have been expended in filling, and the result is onl to raise the water higher, for it has no outlet; and such will continue to be the case until th surface is raised sufficiently to drain into the sewers, which will even then leave the *subso* filled with water, damp, cold, and unhealthy.

The only remedy for this is subsoil drainage, which could be effected at a trifling cost com pared with the cost of raising the surface—in low places sufficiently to drain into the sewe and with the benefit to be derived therefrom. The cost of raising a single block one foot hig would require 16,800 cubic yards of earth; this at a cost of 30 cents per cubic yard woul amount to $1,866 60; sufficient at one dollar per foot to construct 1,860.6 feet of drain, or a two dollars per foot, 933.3 feet of drain, which would dry the soil to a depth below the surfac depending on the locality. In the vicinity of B, C, and D Streets, where the sipage water stand longest on the surface of the ground, the soil could readily be drained to a depth of five fee lower than at present; while in the vicinity of Fifth and P, Q, and R Streets, some good coul be done; but at the latter points the general surface of the ground is so near the level of th water at the outlet that the advantage gained would not be so great. Still it would amount t something, and that advantage would be greater the greater the distance from Sixth and I Streets.

Baldwin Latham, C. E., author of a work on Sanitary Engineering, says in regard to th subsoil drainage of the sites of towns: "The advantage of complete subsoil drainage of the site of towns appears to be so great that every effort should be made, and no expense spared i order to secure perfect works for drying and aerating the subsoil of all urban districts. The exten sive works of subsoil drainage that have been carried out in every civilized country in th interest of agriculture show, beyond doubt, that both the health of animals and plants is materi ally benefited by works of this character. In town districts, where the soil to some extent natu rally becomes polluted by the absorption of gaseous impurities from the air, or by the admittanc by percolation of decomposing matter from the surface, it is absolutely necessary, in order to ren der the soil capable of performing its function of oxidizing and neutralizing the elements o decomposition which are brought into contact with it, that works of subsoil drainage should be prosecuted. It is now well known that the abundant admission of air into a soil enables tha soil to exert the most powerful chemical influence upon all organic compounds, so great indeed as to be capable of purifying the crudest sewage. The effect of drainage upon the soil is to pro mote porosity, and the effect of porosity is to make the soil dryer, warmer, and less capable o conveying extremes of temperature. It is also well known that a soil perfectly saturated with water, which can only part with its water by evaporation, is rendered cold and unwholesome as a site for human dwellings, for all impurities that enter the soil accumulate."

With the subsoil of *our* city well drained, there can be no doubt but that the benefit derived in its increased healthfulness would more than repay the cost of doing the work; for, in many localities, there can be no doubt that a large portion of the sickness is caused by the cold, damp nature of the soil.

As our system of drainage is at present constituted, every particle of the rain-fall in our city, as also the sipage, and what is pumped into the city, has to escape by evaporation or through the sewers. The result is, that probably during the rainy season nine-tenths of the water that enters the city has to be absorbed by the soil and retained until the fall of the rivers, when the heat of the sun becomes sufficient to evaporate it.

The outfall for the sewerage from the City of Sacramento is very poor, especially late in the rainy season, when the country below the city becomes filled by the accumulated rain-fall of a wide scope of country, assisted by the sipage from the Sacramento and American Rivers, and the backwater from the Mokelumne and San Joaquin. This outfall is protected from back- by a cross levee at the head of Snodgrass Slough and another at Freeport, with flood-

gates through which to permit the water above to flow off after the backwater (or flood water) has gone down. The outfall is also protected from overflow from the Sacramento River by a levee on the river bank, constructed to a width of six feet on top and two feet above the high water of 1878. Without this levee, the country below Sacramento would be flooded nearly every winter, and all the water, including the sewage, rain-fall, and sipage, would have to be pumped out of the city, as was the case in 1878, when a break in the levee a short distance below Sacramento caused the water to back up to the city and stand several feet deep outside the R Street levee.

In conclusion, I wish to indicate what, in my opinion, would be the best system of sewerage and drainage for the City of Sacramento. That system would be, in my opinion, a double one, having a system of pipes and connections for carrying off the sewerage to a point outside the city, where means should be provided for pumping it and distributing it over an area devoted to cultivation by irrigation; a second system of drainage, with supplementary ditches and drains, should be provided for carrying off the rain and sipage water which should be permitted to escape by its natural outlet to the low country below the city by the way of the drainage canal.

Located at the junction of the Burns Slough ditch with the Sixth Street ditch is a sufficient quantity of land well adapted to cultivation by irrigation. Here pumping works should be located and here a reservoir should be constructed, from which pipes, for conveying the sewage, should extend into all parts of the city. During the greater part of the year a pump of moderate capacity would raise the sewerage as fast as supplied from the city. During heavy storms or while the sewers were being flushed, it might be permitted to overflow and escape with the rain and sipage water.

By this means the sewage and drainage water could be kept separate, thus reducing the cost of pumping to a minimum; the hight of pumping would not be so great as to pump into the river, and the return from the sewage used for irrigation would, at least in part, pay the expense of pumping; the sewers, being independent of the outfall into the country below (which is very poor) could be placed as low as necessary, thus giving the necessary fall for making the sewers self-cleansing, and preventing their becoming choked from the deposit of the heavier sewage matter; the soil would not become polluted as is the case with the sewage running in an open ditch, and the air would not be filled with noxious, poisonous gases and unsavory smells, as is the case at present.

In Sacramento, as in other cities, a serious danger is to be observed in the inefficient protection afforded against the escape of sewer gas into houses—the faulty water-closets, the defective traps, the imperfect ventilation of drains, and very often the shiftless, unscientific arrangement of the plumbing designed to avert the danger arising from such sources.

The sewer system of Los Angeles is as yet incomplete. It consists principally of one brick cemented sewer-main, extending for a distance, probably, of nearly three miles, with side drains connected therewith. The main sewer is about three feet wide by two feet high, and possesses a fall of three inches to one hundred feet. With the exception of that portion of the city lying west of Main Street, all descriptions of sewage are permitted to pass into the sewer, whence they are conveyed to and deposited upon a field, to be utilized as fertilizers. The side drains are, many of them, said to be imperfectly trapped and ventilated. In many portions of the city cess-pools are still used.

For the following report on the sewerage system of Oakland, acknowledgments are due to the City Engineer, T. W. Morgan, Esq.:

Nos. 1, 2, and 3—The system of sewerage, by which the City of Oakland is designed to be drained, is as follows:

First, to take advantage of the natural topography and arrange the sewers so that the flow of sewage will be in the direction of the general flow of the surface water, as near as is possible, and at the same time have the sewers in the public streets.

The topography of that portion of Oakland lying between the lake and the Bay of San Francisco is as follows: The highest point in the main part of the city is at the crossing of Twelfth and Washington Streets, this being thirty-eight feet above ordinary high tide. Running east and west from this point is a ridge which divides the waterfall. About one-third of the city south of Twelfth Street drains to the south into the estuary; one-third, north of Twelfth Street, drains to the north to Twentieth and Twenty-second Streets; the other third, south of the northern boundary, drains to the south and west to Twentieth and Twenty-second Streets, where the ground is low.

MAIN SEWER.

A main sewer was constructed through this low ground, running from Lake Merritt to the shore of the bay. It is two miles long, is five feet wide by five and one-half feet high, of brick

on the solid ground, and of wood on the marsh, and receives the sewerage from the north ar the south, and discharges the same into the bay.

At present there are six sewers from the north and twenty sewers from the south dischargi into this main sewer. There is a continual flow of the sewage through the main sewer. Th high tide is kept from flowing back into the sewer by a self-acting gate which closes by th pressure of the flood-tide. As the tide recedes this gate opens, and when the tide is out th gate at the lake is opened by hand, and the water of the lake being from two and one-half three feet above the bottom of the inlet, a strong current rushes in and thus scours out the sewe

The water in the lake is kept up by the dam at Twelfth Street, which is supplied with floo gates, which let in the flood tides and keep the water from going out with the ebb tide. Fro this it may be seen that we have a most perfect system of sewerage by maintaining the da and flood-gates at Lake Merritt. Without these the main lake sewer would not work succes fully as it now does.

The sewers in the southwest portion of the city drain, at present, into the marsh lands ar the sloughs therein. Sooner or later a main sewer will be required to take the sewerage fr this quarter, for the outlets of these sewers will soon be closed by the filling in of the ma lands; and the distance to the estuary is too great, there not being the necessary fall to admi the sewers being continued thereto.

The greater portion of East Oakland has sewers which discharge into the estuary. The nor western portion, near the lake, and the adjacent portions of the territories which are known Clinton and San Antonio, have no sewers at present. The drainage is into a creek or ravi along which there has been recommended a main sewer. For the northwestern portion plan was submitted to the City Council for a system of intercepting sewers, which would pr vide for the said northwestern portion of East Oakland.

No. 4—The sewers are used for all kinds of sewage matter.

No. 8—The sewers in main streets are constructed with cement or iron-stone pipe, abo equally divided. The earlier sewers are of cement, but latterly the iron-stone pipe has be more generally used.

No. 9—All the sewers, with the exception of four, are provided with flushing man-holes lamp-holes.

No. 10—As to ventilation, there have been no extended means provided in the street sew The man-hole covers are perforated more or less, but these generally become stopped after bei traveled over, as the dirt thereby lodges into the holes. In the main lake sewer there was provision made for ventilation, except its being open at the two ends above the water; it thought by the engineer that there would be a current of air through its entire length, as outer end faces the prevailing westerly winds, and the sewer lies in the direction of the win This expectation has been realized. In the dry season the catch basins along the main se at each street corner become dry, so that there is no water seal by the trap-wall; they t afford ventilation to the sewer; but this is not a desirable method of ventilation, for the gas odor from the sewer is inhaled by persons passing by. In winter, when dwellings are clos for comfort, this ventilation is stopped by the catch basins being filled with water, and the must find an escape into dwellings through imperfect traps. In my judgment there should either one or more large ventilating chimneys constructed in some portions of this city, of s ficient hight and draught to draw the gas from the upper ends of the sewers, through pip laid for the purpose along the summits of the drainage.

No. 11—There are many cess-pools used where there are as yet no sewers in the street on whi the property fronts; they are generally pumped or bailed out, and the contents sometime allowed to run over the ground. In many instances they are abandoned or filled up and anothe one dug on some other portion of the lot.

No. 12—The cess-pools are not generally water-tight, so that they allow the fluid portion o the sewage to soak through the earth. In some few cases they are ventilated; generally the are not.

No. 13—There is usually a trap in the sewer leading from the house to the street sewer jus outside the building, and the drains at the house are connected with leaders to the eave-trough for the purpose of ventilation; but this plan of ventilation is objectionable where the top of th leader is near the windows of upper stories, or on the top of one-story bay windows or verandas.

I would say, in connection with this matter, that there ought to be some officer of the city with authority to inspect every house and see that proper drains, connections, traps, and ventilators are constructed, and who should enforce strict compliance with such regulations as may be determined upon by the city authorities for the promotion of the health of the city.

Respectfully submitted,

T. W. MORGAN, City Engineer.

OAKLAND, July 12th, 1879.

SEWERAGE OF MARYSVILLE.

A general idea of the sewerage of this city may be obtained from an examination of the accompanying "chart," which has been kindly furnished by Dr. A. B. Caldwell:

This city is located in an angle formed by the Yuba and Feather Rivers. In general terms it may be said that the sewage from the lower or southern portion of the city empties into the Yuba; that from the upper or northern, and eastern and western portions, into a slough, which ultimately flows into the Yuba. The drainage of the lower portion is effected, in part, by two brick sewers—one being on D Street, from Fourth to the river, the other on B street, from Third to Front. Cross streets and alleys are connected with these by surface drains—troughs or wooden gutters—running along each side of the street. The drainage of the upper portion is effected by surface drains, many of them being open gutters. Such is a general outline of the system hitherto adopted.

During low water in the Yuba, the plan was for some years effectual in providing a means of escape for the sewage, but during the high stage of the river the outlet of the sewers was under water for many feet, and the river itself backed through them into the town. This was remedied, in part, by a flood-gate, which kept the mouth of the sewer closed for a considerable portion of the year. At the present time the sewer outlet is said to be four or five feet beneath the debris and sand by which the river has been gradually filled up.

No information was obtained as to the existence of traps between the bath-tubs and kitchen-sinks and the drains.

The filling up of the river bed by debris from the mines has rendered the present plan of sewerage entirely inefficient, and it is said to be in contemplation to do away with the two large brick sewers and substitute smaller and more superficial surface drains. The evils attendant upon these surface drains are evident to every observer; yet they must inevitably arise as a result of the hot sun of summer upon the foul water they contain, their wet but drying borders, and the decomposition continually going on in the wooden drains themselves. In fact, there is said by Dr. Caldwell to be a very evident connection between the character of the drains in some localities and the sickness prevailing there.

There is a manifest impropriety, too, in permitting the drainage of a city of seven thousand inhabitants, with its hotels, foundries, and factories, its stables and butcher shops, to run into a river which, though not itself used for domestic purposes, empties within a distance of sixty miles into one that is so used by a large population. The right of self-protection is a law universally recognized and observed, but it is a right which should not be exercised to the injury of an innocent and unsuspecting public. We have no right to assume that no detriment will result to the health of those ultimately using such water, even though the sewage it contains be vastly diluted, and though it has been agitated and exposed to the oxidizing properties of the water and the air through a course of fifty or sixty miles before reaching the populous city of Sacramento. Such an assumption is in direct variance with the opinions of those who have most attentively studied the subject, and the practice can be followed only by a direct violation of the law relating to the pollution of rivers.

Doubtless engineering skill is capable of suggesting a remedy. If not, the irrigation system applied to the extensive area now covered for many feet in depth by the unprofitable debris washed down from the mining regions, would afford relief, and become the means of enriching many acres of land now unfit for cultivation, and making them to teem with rich harvests of golden fruit.

Privies are in general use by the residents in all portions of the city, some of the vaults being cemented and connected by pipes with the indoor water-closets. Most of these are trapped, and many of the privies ventilated by the Eastmond and Cottier plan. They are usually emptied annually, or as occasion requires, by the odorless excavator, and what is more objectionable than anything yet stated, their contents are said to be generally, though not always, thrown into the Yuba River.

THE HYGIENE OF DWELLINGS.

Among the objects which most demand the attention of the sanitarian, and which are rightfully considered to be essential to the comfort and health of the individual, is the construction of the house in which he lives. A man may pursue his daily avocations amid filth the most disgusting, and surrounded by insanitary conditions of the most offensive character; he may breathe the diluted vapors which circulate and diffuse themselves in the atmosphere, but they come to him in a state so attenuated as to be, in a great measure, innocuous. It is well known that laborers upon sewers and cess-pools may, and often do, prosecute their work of repair or of removal of their foul contents, day after day, inspiring the fetid gases of which they are the source, without apparent discomfort or injury. But it is equally true that the case is far different when these same gases enter the dwelling in which an individual lives and concentrate themselves within the narrow inclosure of the bed-chamber. There are certain gases, too, and vapors, which proceed from man himself, the product mainly of the vital function of respiration, but to a certain appreciable extent of exhalations from the body, which, under similar circumstances, may undermine his health or even occasion serious disease. This is especially true of the vapors and other substances which emanate from the bodies of the sick. Of reason, then, the hygiene of the dwelling may be regarded one of the most important subjects of inquiry. Men, everywhere throughout the wide range of civilization, have exhibited a certain degree of pride in the construction of the dwelling—the home. With rich and poor alike, the predominant idea has been the security of what each one in his different sphere has come to consider *comfort*. In the attainment of this one prominent and laudable feature, another sentiment is exhibited by the rich, and individuals vie with each other in the display of beauty, elegance of design, and costliness of structure; while the poor, struggling with the decrees of a hard destiny, are compelled to content themselves with the humble cottage which poverty bestows. Both may attain a certain degree of *comfort*, and be content. Yet in this strife for comfort, this ambition for display, how few ever pause to think of that which is the very essence of all that is worth striving for—health. The mansions of the rich are often no better in this respect than the cottages of the poor—nay, sometimes worse; and it frequently happens that the peasant in his humble cabin by the hillside, or amid the tall pines which chant their solemn music in the breeze, is more to be envied for his share of this one essential than the prince in his palace. This can scarcely be considered surprising when we contemplate the ignorance and carelessness so often manifested in the construction and management of what are commonly designated *modern conveniences*, and the gross neglect of the trapping

and ventilation of house-drains. The dangers arising from such sources affect especially the dwellings of the higher classes of society, for the poor are usually compelled, by the force of circumstances beyond their control, to be satisfied with more primitive and simpler arrangements.

The circumstances proper to be here considered, under the general head of the hygiene of the dwelling, are the site, the construction, and the arrangements for the disposal of sewage and excrementitious substances. Among the first considerations to be attended to is the selection of a suitable location. This, it is true, is not always within our control, for the business relations of life, commercial interests, or motives of economy, will often compel the adoption of a locality which a strict respect for sanitary precepts would scarcely justify. In discussing this question, therefore, we are under the necessity of considering what should be—what a prudent regard for health requires, leaving each one to approximate it as closely as circumstances will permit. The location should be *dry*, naturally, or susceptible of being made so by drainage. Some of the evils resulting from dampness of soil are familiar to every one. Every one recognizes its agency in the causation of catarrhal affections, rheumatism, and the like. But it is not so generally known that from such sources more serious diseases—certain scrofulous developments, more especially pulmonary consumption, not infrequently arise. The investigations of Dr. Bowditch, of Boston, Massachusetts, already alluded to in a former part of this report, and of Dr. Buchanan, of England, leave no room for doubt upon this subject. Indeed, among the principles which lie at the foundation of sanitary science, this question of soil dampness is of the most positive and unequivocal character, surpassing almost all others in the magnitude of its evils and the certainty of its results. "Medical opinion," says Dr. Bowditch, "as deduced from the written statements of resident physicians in one hundred and eighty-three towns, tends strongly to prove, though perhaps not affording perfect proof, of the existence of a law on the development of consumption (in Massachusetts), which law has for its controlling idea that dampness of the soil in any township or locality is intimately connected with the prevalence of consumption in that township or locality." The English reports speak even more positively upon this subject, showing a reduction of the death rate by consumption, as the result of *drainage* of wet soils, in one town, 32 per cent.; in another, 17 per cent.; and in a third, 49 per cent.

Indeed, it has recently been rendered probable by the experiments and observations of Surgeon T. J. Turner, United States Army, that moisture, when excessive in the atmosphere, is not alone detrimental in the manner commonly supposed, but that it is in reality an impurity, increasing the amount of carbonic acid, diminishing the exhalations from the skin and lungs, and limiting excretion. It is stated that life cannot endure for any length of time in an atmosphere saturated with moisture at a temperature of 90° F. to 100° F. When, therefore, necessity compels the selection of a building site upon damp soil the defect should be remedied by deep drainage; and where the topography is such as to make this impracticable, as upon low and level lands, such as are met with in many of the valleys of California, without outfall for the underground water, cellars should be avoided, and the dwelling erected sufficiently above ground to

provide for free circulation of air and ventilation between the latter and the lower floor of the house. Indeed, cellars, in almost all soils, are a source of dampness, receptacles for moisture, and become the frequent cause of disease. They should at least be well ventilated—better, drained from beneath, or lined, upon the floor and sides, with good cement.

Made soils—those made from rubbish, the sweepings from streets, and other materials containing much animal and vegetable matter liable to decomposition—should also be avoided. In some cities, or in special localities in cities, a high rate of mortality from cholera infantum during the summer and autumn months has been attributed to this cause alone. Its influence in the production of malarial fevers, also, is familiarly known.

Another important suggestion as to the selection of a building site, is its *exposure to the sunlight* and to the winds—that is, to a free circulation of air in and around the dwelling. The effect of the former upon the growth and nutrition of the body is well known, as is also that of the latter as a means of ventilation. The frontage of the house, therefore, taken in connection with the usual course or direction of the winds, deserves consideration. As a rule, a southern frontage, even in the valleys of California, is to be preferred. There is a freer access of the sunlight, and the prevailing winds being from this direction, the construction of the building can be so arranged as to afford a free and uninterrupted circulation of air. Viewed in the same connection, the planting of trees and shrubbery becomes a measure of more or less importance, according to the meteorological features of the climate. Apart from the beauty and attractiveness of such vegetation—its æsthetic effect—it exercises an efficient and salutary conservative influence, especially in a warm climate. Trees absorb moisture both from the soil and from the atmosphere. They exercise a lowering effect upon the temperature in consequence of the constant evaporation going on from their foliage; they cool the ground by shutting off the rays of the sun; they also check, to a very considerable extent, the velocity of the winds; and serve frequently to obstruct or intercept malarious currents. Yet it often happens that the cultivation of trees is carried to an imprudent excess. They exclude the sunlight; the free circulation of air is impeded and it becomes stagnant and unhealthy. This extreme is frequently observed in the valley cities of this State, where considerations of health are sacrificed to the beautifying and adornment of the home. "The sun's rays," says Doctor Donaldson, of Baltimore, "not only prevent dampness and mustiness, but they purify the atmosphere by destroying organic matters."

The materials of which a dwelling is constructed are not altogether a matter of taste or fancy. Whether we regard the long hot season of the central valleys of California, for example, or the almost equally long rainy season, it is believed that frame buildings are generally to be preferred. Though warmer in summer than those of brick, they are rapidly cooled as evening approaches, while they are drier and more conducive to health in winter. Brick structures, unless built upon an elevated, well drained site, or protected by a layer of some impervious material above the foundations, take up moisture from the soil and are apt to be damp, while the rains of winter, falling upon their surface, are absorbed in considerable quantity. They are consequently often damp, and this objection is not entirely removed

by the usual method of inside plastering. Outside plastering or cementing, or even painting, however, affords partial protection; or the walls may be double or hollow, with ties at suitable intervals to secure strength.

But there are strong objections to the use of damp-proof paints, or cements, upon the exterior of a house. They succeed, indeed, in keeping the dampness from without from entering the house, but they securely imprison that which arises from various sources within. The condensation of the latter renders the walls damp—a condition of things which the Professor of Hygiene at Munich compared to the wearing of India-rubber clothing. "Both protect from exterior wet, but as they impede the exchange of air between the inside and outside, they generate a wetness in the interior—upon the skin, or upon the walls of the room." (Eassie, Sanitary Arrangements, etc.)

The hollow walls just spoken of, properly constructed and well *tied*, are doubtless the better reliance.

The vitrified stone-ware has also been successfully used as a single *damp-proof* course above the foundation of a building—tiles or slabs being made an inch or two in thickness, and perforated for purposes of ventilation. It is a significant fact, in this connection, that dry bricks will absorb not less than one-third their weight of water.

But quite as important, in a sanitary point of view, is the *construction* of the building as respects its warming and ventilation, its drainage, and the arrangement of its sinks and closets. These are, indeed, the chief factors upon which the healthiness of our dwellings depends. To these subjects the remainder of this paper will be devoted.

The first two of these essentials are intimately connected, for the means provided for the former are such as are often made available for the latter. The old-fashioned fire-place, for example, with its chimney, affords, under certain circumstances, an effective means of ventilation. The current of air, and consequently the extractive power of the chimney, depend in part upon the degree to which the former is heated, or in other words, upon the size of the fire; a constant current is set up from the inlets of air towards the fire-place, and, according to some authorities, another movement is set up along the ceiling, down the walls, and along the floor towards the chimney.

In this connection, or at least in the Sacramento Valley, with an average velocity of the air in summer of nearly nine miles per hour, and of about eleven miles in winter, it is usually not difficult to obtain ample and proper ventilation by a suitable arrangement and construction of the windows. Whatever may be the plan adopted, the important points are to avoid a *draught*, and to keep the air of the room in such a condition that there shall be no excess above the normal amount of carbonic acid—probably about .06 per cent. The regulation of this is easy in the private dwelling as compared with the difficulties encountered in hospitals and some other public buildings, and need not be dwelt upon. "As a rule," says Denton (Sanitary Engineering, p. 103), "it may be stated that dwellings built upon a dry soil, which maintain in their several apartments the full amount of air required for animal respiration and the combustion of fuel used in each apartment, and which is generally gained by properly divided doors, windows, and fire-places, will maintain

their [the proper] standard without any special efforts at ventilation."

Among the devices for warming the apartments occupied in winter, none are so simple and, in general, so agreeable as the old-fashioned fire-place. In our climate, at least in the valleys and along the coast, where extreme cold is never felt, even the objections commonly urged against it in an economical point of view do not obtain to any extent, though open to the inconvenience of warming the room unequally, etc.; yet it may be readily seen that, under certain circumstances, it may be productive of evil. The air of the room being heated by reflection and radiation is unequally warmed; it is warm near the fire, while a current of cool air, established from without around the windows and beneath the doors, keeps more distant portions of the room cold. Various contrivances have been adopted to obviate this difficulty, as, by the construction of the grates so as to increase their radiating power. In many well-constructed dwellings the method of heating by means of hot water pipes, or pipes through which steam is circulated, is now adopted, the readiness with which heat may be conveyed to any part of the house, and the uniform temperature capable of being secured, rendering these methods especially convenient. However valuable such an arrangement may be, it can never entirely supersede, for ordinary purposes, the open fire-place or the open grate. The objections to the latter have been removed by the construction of an air chamber on the back and sides through which external air passes into the room.

But there is no part of the dwelling, no special feature in its arrangement, more interesting or essential than its *drainage*. The word *drain* is here used to signify that system of pipes or ducts by which the waste water, slops, kitchen refuse, suds, and the contents of water-closets are conveyed away to the receptacle assigned to the purpose—in other words, to the house sewer, as subordinate to the main or public sewer. The latter, where a system has been established, is a matter which concerns all who connect with it—it is commonly supervised and regulated by the public authorities; the former concerns distinct and often isolated individuals and families and influences the health and comfort of the household.

Commonly the drainage of the house comprises two systems—one connecting with the main sewer by which the waste water of the kitchen and of baths is carried off; another, designed especially to convey the contents of water-closets to their destined place.

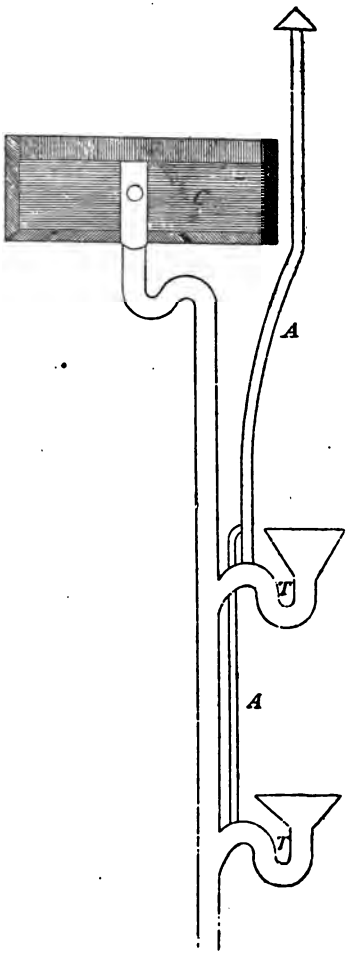
In the arrangement and construction of both, the chief concern should be to keep the gases which arise from entering the house and poisoning its inmates. No fact in sanitary science is now better established than that sewer gases do arise from the sources indicated, and that they do, without proper precaution, find their way into dwellings and become the source of disease. The records of medicine are replete with the evidences of these facts, and the recent investigations of sanitarians in this country and in Europe have placed them out of the reach of successful contradiction. It is indispensable, then, that all communicating drains should be properly constructed. The materials of which they are composed should be sound, non-porous, and the drain should be laid with a *fall* or slope sufficient to carry off, without obstruction, the materials discharged into them. Glazed stone-ware pipes are generally considered the best, being durable and so smooth upon the inside as to

facilitate the easy and uninterrupted passage of their contents; and they should not be too large, thereby diminishing the rapidity of the current through them. In general, pipes of four or six inches diameter, with a fall of one and a half or two feet per hundred, will suffice for an ordinary house drain. They should be properly *trapped and ventilated.* If the ventilation of the main sewers of a city is necessary for the protection of all who form local connections with them, surely it is equally important that the communicating drains leading from isolated dwellings should be provided with a ready means of escape for the gases of decomposition arising therein. The latter precaution is, in fact, of even greater importance in consequence of the frequent imperfection of the sewers of cities, the inadequate ventilation provided for them, and the absence of any intelligent supervision over them. They are often ineffectually flushed, become foul, the gases generated within them must find an outlet, and none so accessible as that which, under the arrangement often adopted for the communicating drains, finds its exit into the bath-room or living rooms of the dwelling. The higher the temperature of the air of the room as compared with that of the drain or sewer, the more rapid and certain the inflow of polluted air.

The construction of a drain with a view to its efficient ventilation will depend in some measure upon the uses to which it is to be put. In many cities, with ample water facilities and a suitable outlet for the final discharge of sewage, drains are adapted to the conveyance not only of the refuse from the kitchen and bath-room, but also for the contents of the water-closets, and, wherever practicable, the system is to be recommended. Privies and cess-pools, with their abominations, their dangers, and their inconveniences, are thus avoided. But in other towns, and in isolated dwellings, especially in the country, such a disposition of the excremental refuse from the water-closet is impracticable, and the CESS-POOL or VAULT is resorted to as a recognized, though necessary, evil. To reduce the dangers arising therefrom to the minimum they should, as previously stated, be well cemented so as to be water-tight, arched over, and ventilated at the top, and sufficiently small to require emptying at least once or twice a year, and frequent disinfection. As commonly built they are mere holes, loosely bricked or boarded up in such a manner as to permit the percolation of their liquid contents into the surrounding soil, thence to flow, it may be, into the well from which the drinking water is supplied. Too many instances have been recorded of the dangers arising from these sources to permit a doubt of their reality. However these conditions may be—whether intended to convey the contents of water-closets or of sinks or bath-tubs, or a mere kitchen drain leading, as is often the case, to an open hole dug in the ground near by, whether designed to connect with the main sewer of a city or with a cess-pool, the drain must be *ventilated.*

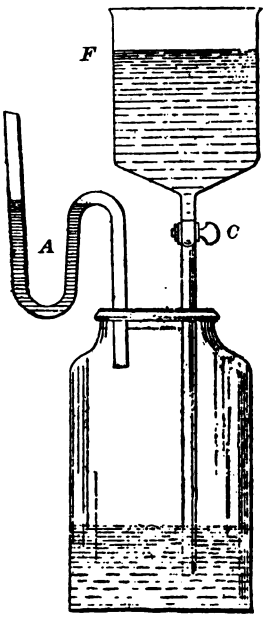
Various plans have been adopted to effect this purpose. One of the most efficient—the only certain method—is, to be found in the construction of the soil-pipe, its continuation above the roof of the building, thus forming a ventilating shaft, which should be without abrupt or angular curves, and of equal diameter in its entire length. This diameter should not be less than that of the trap or traps it is designed to connect with it during its course. Denton and others advise, also, the ventilation of the closet-trap as well as the soil-pipe.

which may be readily effected by a small pipe extending from the upper curve of the trap to the ventilating tube above the entrance of the trap into the soil-pipe.



This is esteemed to be particularly necessary when two or more closets are connected, one above the other, as upon the different floors of a house with a single ventilating tube, for as shown by Latham (Sanitary Engineering, p 402), water flowing down the latter from above is likely to untrap all the closets below on the same line of pipe, by virtue of an induced current of air which, entering by the several traps, passes along with the water and creates a vacuum behind it. The attachments of separate ventilating pipes, as shown in the cut, taken from Latham, at the top of each trap, will correct the evil. Here O is the overflow pipe from the cistern C; T the trap or traps; and A the ventilating pipes inserted at the tops of the traps. "If ventilation is used in this way," says Latham, "the effect of the induced current still remains, but air can enter the drain, and the traps will remain intact." For the further purpose of preventing the syphonage of pipes in the manner shown, the recent ingenious invention of Mr. Morey has been much used of late in California. It is not intended to supersede the use of a properly constructed air pipe, but simply as a substitute in buildings already erected and in which the former has been neglected. "It is soldered," says the description given, "on traps already in use at the highest part of the bend. Any tendency of the water passing through the discharge pipe to create a vacuum causes the valve to lift, and the air rushes into the pipe, destroying the vacuum and preventing the trap being drawn dry. The water ceasing to flow, the valve drops by its gravity into its seat, forming an air-tight joint preventing the escape of noxious vapors." In carrying the ventilating pipe above the roof of the house care is to be taken that it does not terminate near the windows, or even the flue of a chimney. In certain directions of the wind, or under certain conditions of temperature, incurrents into the house may be established, which will carry with them the gases but just escaped from the soil-pipe. No dependence whatever should be placed upon the water seals of soil and waste-pipe traps, nor on that remaining in the basin of the closet during the intervals of its being used, for, though they are capable of intercepting, to some extent, the passage of sewer gas, they afford only a slight resistance to the strong pres-

sure by which the latter is often forced or drawn into a house. They can never be considered safe without ventilation of the waste-pipe. They are liable to be unsealed by slight causes—by a difference of temperature between the air in the sewer and that in the house; by the formation of a vacuum when large bodies of water are poured down through the waste-pipe; by the sudden accumulation of water in the sewer as by rains; by evaporation, when not frequently used, and by other causes. How little force is needed for the purpose of unsealing such traps may be understood by the fact that "a seal of three inches deep offers resistance to the passage of air equal only to a pressure of two ounces for five square inches."



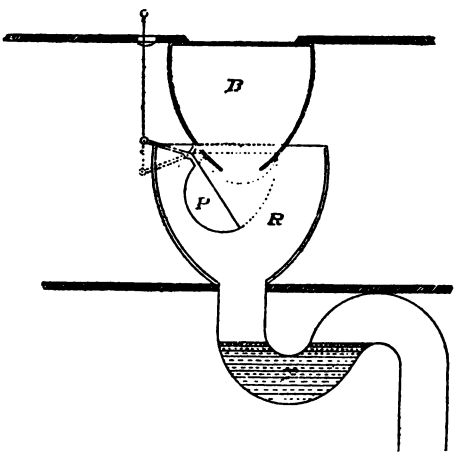
A simple experiment, originally suggested by Latham, but frequently referred to, will explain at least two ways by which the water-seal of traps may be displaced:

First—The expansion of the air under an increase of temperature.

Second—The increase of pressure and consequent unsealing of the trap, when the quantity of water is suddenly increased in the sewer.

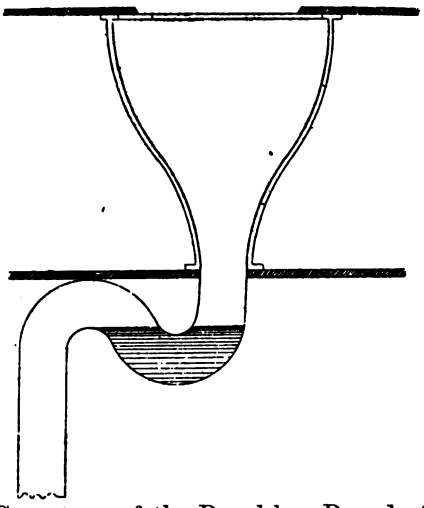
If water be placed in the bent tube representing an ordinary trap at A, and the warm hands be made to grasp the glass jar, the air in the latter will be so expanded as to throw the water out of the tube. On the other hand, if the water contained in the funnel F be suddenly allowed to flow into the jar, by turning the stop-cock C the water in the trap A will be similarly forced out. The cut is taken from the excellent work of Geo. E. Waring on the Sanitary Drainage of Houses and Towns.

In the course to be pursued for preventing the escape of sewer gas into the house, something will depend upon the form of water-closet used. These are of various kinds. One of the most common is the pan closet. It consists of a porcelain basin B resting upon and entering into an iron receiver R by means of a pan. When the valve P is raised, the contents of the basin pass into the receiver and thence into the branch leading to the soil-pipe, having a trap. This trap contains, or is supposed to contain, water, and constitutes one seal; the water in the bowl above the pan serves as a second water-seal. This closet is figured in the accompanying cut taken from the report of the Board of Health of Brooklyn, New York, 1875–6.



One of the most serious objections to this and similar closets is that the foul air from the sewer and soil-pipe must inevitably escape when-

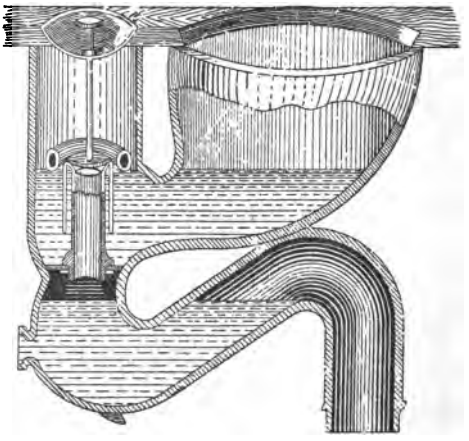
ever the pan is lowered and the water allowed to rush through. The volume of water displaces an equal volume of air, and the readiest avenue of escape is into the room. In addition to this, the receiver itself, becoming fouled by adhering masses of matter discharged into it, proves to be the source of foul air ready to escape when the pan is lowered. An examination of one of these closets, after being used for some time, will reveal the presence of such foul accumulations, not only in the iron receiver but also in the lead trap leading therefrom. When these closets are used a ventilating tube passing from the receiver into the soil-pipe, upon the principle suggested by Denton, becomes indispensable; but even this precaution does not fully remedy the evil.



The common hopper or syphon closet is one of the cheapest, and in the opinion of some a more desirable closet than that last described. It is of one piece, made of porcelain, and having a perfectly smooth surface, is little likely to retain the matters passing over it. It terminates in a trap containing water, from which the branch is extended to the soil-pipe. When the latter is well ventilated, as indicated above, and when the supply of water for flushing the trap is abundant, this closet is probably less objectionable than any other cheap closet now in general use. The cuts for this and the next closet are taken from the report of H. A. La Fetra, Secretary of the Brooklyn Board of Health.

As a general rule the best closets, though costing more in the beginning, are ultimately the cheapest. They are more perfect in their construction, less liable to get out of repair, more cleanly, and better adapted for the exclusion of the gases of decomposition.

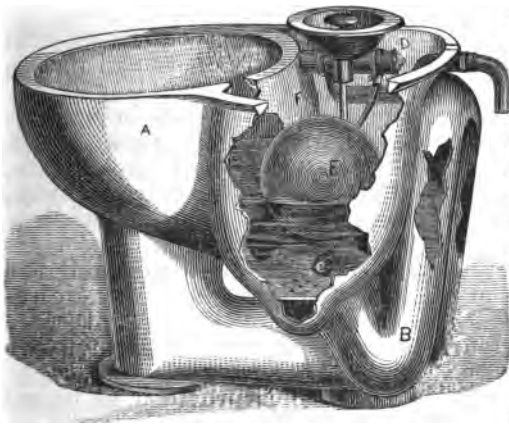
One of these is the "Jennings Closet," which, as recently improved, probably presents the most perfect conditions for safety. It is one piece of glazed earthenware from the seat to the soil-pipe; the whole quantity of water necessary for flushing is contained in the bowl just underneath the seat, and by simply lifting the valve, it is carried suddenly and forcibly away through the trap into the soil-pipe and drain. The volume of water is so great, however, that the perfect ventilation of the soil-pipe is absolutely necessary to prevent the foul air in the latter, displaced by the water,



from being forced up into the house. This secure, it is all that can be desired. Instead of the *hollow* plug commonly used, which was thought liable to allow the effluvia generated in the trap to pass through it into the house, it is understood to have been recently improved by the substitution of a solid plunger and a trapped overflow from the bowl.

Another form of closet recently introduced is the "Twin Basin Closet," by Pierson, in the arrangement of which much reliance is placed upon the deep water-seal in the basin, the solid plunger with its rubber flange by which the discharge of water from the bowl and the entrance of air from below are prevented, while the overflow pipe, which is also of earthenware, and a part of the closet itself, carries the excess of water from the top of the bowl down to and below the plunger. The valve of this closet is self-acting, acted upon by a float which rises and falls with the depth of water in the basin.

The following cut taken from the report of the Brooklyn (N. Y.) Board of Health, 1875–6, will explain the peculiar features of this closet: A represents the bowl; B the overflow; C the plunger; D the valve; E the float. Various other forms of water-closets have been introduced; those which, when in use, are odorless, properly trapped and sealed against the ingress of sewer air, simple yet durable in construction, and provided with an arrangement for rapid and complete flushing or washing out of the closet and its trap, being the only ones to be recommended, even though the most expensive.



Defective water-closets, liable to get out of repair, poorly sealed, poorly trapped, poorly flushed, and inefficiently ventilated, have been compared to defective boilers. Death or injury, though not so sudden, perhaps, is scarcely less certain.

The location of the water-closet is a matter of some importance. It should never be placed in the sleeping apartment nor in apartments directly opening therein, such as closets, dressing-rooms, and the like. Authorities advise that, where there is no danger from the frost, it should be located outside the line of the house, as a projection from the latter; but, under any circumstances, it should be placed in a room closed from the other rooms of the house by an intervening passageway or lobby, and having one or more windows opening to the outside. With a properly constructed water-closet, perfectly arranged, efficiently acting, well ventilated, and suitably cared for, these precautions may not be necessary; but the dangers of slighted and imperfect plumbing, of neglect, or of careless management, are too great to be overlooked.

The above remarks concerning water-closets are, of course, based

upon the condition of a sufficient supply of water. It should be ample for the water-seals of the closet basin and the trap, and for flushing when required; constant, not intermittent, nor subject to interruptions. To fulfill these purposes, it is advised to erect a reservoir upon the roof connected with the common source of water supply, having an overflow-pipe and regulated by a float, thus avoiding the risk of failure from breakage or other derangement to which the machinery of the water-works of a city are occasionally subject; but it is essential, when the water-closet is supplied directly from the pipes relied upon for water for culinary and other household purposes, that there shall be no danger of the contents of the pan or the foul air above the trap being sucked back when the water falls, as it is constantly doing from the opening of cocks along its line, or between the closet and the water mains.

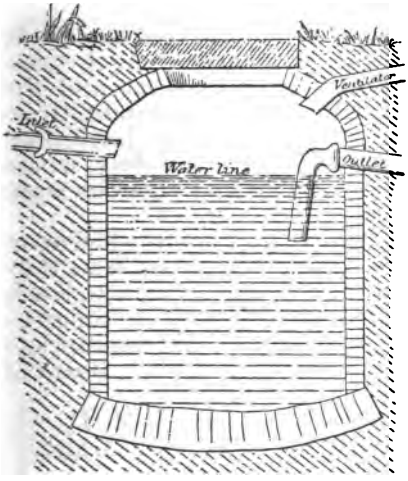
Almost equally important for the security of the dwelling against the inflow of sewer effluvia, is the arrangement made for the discharge of the waste water of the house—that from the bath-tubs, the stationary wash-basins, and from the kitchen. Sewer air may enter in through the discharge-pipes from these sources not less than through the water-closets. In many cases in fact the kitchen drain is the only one supplied, and, as in the case of water-closets, whether the contents are conveyed to a cess-pool or to drains connecting with town sewers, there is no escape from the necessity of its ventilation and proper construction.

We often see in country houses, and sometimes even in sewered cities, the waste water from the kitchen emptying its contents upon the ground just outside the house, or if allowed to open into a drain, it is a small, unsatisfactory, leaky, often open drain, which conveys the materials a short distance to some point in the yard, where it is equally dangerous and equally exposed to decomposition. The odors from these sources are generally offensive and disgusting, and the emanations a fruitful source of disease. Perhaps, and it not unfrequently happens, a shallow well is near by, suitably located to receive the fluids directly from the surface or by percolation through the soil.

In other better arranged places a cess-pool is provided, as before explained, loosely bricked or boarded up, permitting free percolation into the surrounding soil. The effect of a multitude of such cess-pools, one for example in every building lot of a crowded town, continuing its work of contamination year after year, may well be imagined. It is not difficult to see, too, to what danger the drinking water is subjected when reliance for a supply must be upon wells so located. That cess-pools are an evil few will deny; but unfortunately they are too often unavoidable, the absence of any facilities for good drainage making them the only resource. The dangers to which they give rise can be avoided only by rendering them perfectly water-tight, and by relieving them of their contents as often as the accumulation requires. With these precautions and proper ventilation the cess-pool may be elevated in the scale of utility, or at least of evils tolerated, and deprived of its greatest dangers. In any case the waste-pipe from the kitchen sink should be properly trapped, and it would be better if the trap were provided with a screw, as if often done, by means of which the solid particles collected may be cleaned out without the necessity of forcing them into the drain. If to this a ventilating tube passing from the waste pipe just outside

the house up to or above the roof be added, there would be yet further protection against foul air from the drain or cess-pool.

In many cities, as stated above, where the system of sewerage is efficient, both the "slops" from the kitchen and the effete contents of water-closets are permitted to flow into the main sewers; in others, the former only; but however this may be, discharge-pipes, as just stated, should be well trapped inside the dwelling, that is, under the sinks; and it is advised by the best authorities that, when communication is with a connecting drain or sewer, it should not be *direct*, but through the intervention of a gully or grease-trap, with grated or tight cover, for the purpose of intercepting all solid substances capable of obstructing the drain. The principal utility of these traps, however, is to permit the grease constantly discharged from the kitchen to congeal and float upon the surface, the liquid portion passing out from below. Common experience has shown that few things which pass from the kitchen sink into a communicating drain are so liable to choke it as the steady accumulation of grease. The construction of such a trap becomes, therefore, a matter of economy. In the words of Waring: "With a proper grease trap, a four-inch drain will furnish an ample outlet, while without such grease trap no drain can be relied upon to be permanently effective."



The writer, in reconstructing the drain from the kitchen sink at his own residence, a few months since, upon the principle here recommended, found a six-inch glazed earthenware pipe which had been in use about five years, almost completely choked with accumulations of hardened grease and soap.

Various forms of these traps have been devised. The accompanying, taken from Waring (Sanitary Drainage, page 195), has been found to answer well.

The trap is made of cemented brick-work, and so situated as to receive the grease from the sink while still warm, lest the waste-pipe itself should eventually be obstructed by it. The ventilator is to be carried above the roof of the house. Its construction will be understood by an examination of the cut.

The principles upon which the above suggestions have been made are believed to be in accordance with the views of the best modern authorities. The details are for the most part simple, easy of construction, sufficiently inexpensive for any one able to build a house, and, if adopted, may minister to the prevention of disease and the saving of life. How many lives have been lost by inattention to these subjects there is no present means of knowing; but the records of medicine, and especially of modern sanitary science, are replete with demonstrations of the danger of their neglect. The suggestions thus briefly made are not applicable alone to the houses of a city with drains communicating with public sewers; they apply as well to the country home, to the isolated dwelling—to all habitations in the con-

struction of which comfort, cleanliness, and pure air have been considered worthy of attainment. The prevention of disease is one of the chief ends of sanitary investigation, not as applied to the public alone, not alone as reaching great masses of men, but as affecting individuals. The former are too frequently seen to suffer neglect, through ignorance sometimes, through prejudice sometimes, sometimes from mistaken motives of economy. In defective and unventilated sewers float the germs of disease which public policy has been too short-sighted to guard against, and against which the only protection is in individual action. A man's house, it is said, is his castle, which it is his privilege zealously to guard against the intrusion of foes; yet how few pause to reflect that among the enemies which most threaten their security, none are more insidious or more to be dreaded than those which it is one of the objects of sanitary science to point out, but to which, it too often happens, the avenues of approach are all unclosed.

In what has been said upon this subject no attempt has been made at originality. It has been a matter of observation that much ignorance prevails upon the important questions of drainage and the arrangements and method by which it is to be effected, especially as applied to the dwelling. The results of this ignorance have been plainly yet sadly displayed in the course of professional duty, where the home has been pitilessly invaded and bright and vigorous manhood stricken down as the forfeit of unconscious neglect.

Many excellent and exhaustive treatises have been published upon the subjects here briefly reviewed, but these reach only a few; they are usually inaccessible to the masses; and it is with a view to reach these, and afford some useful hints upon what intimately concerns the health of every individual, that it has been deemed appropriate to give them a prominent place in the report of the State Board of Health. Respectfully submitted,

F. W. HATCH, M. D.,
Permanent Secretary State Board of Health.

The following analysis of the water used at the Napa Asylum for the Insane was received too late for insertion in the proper place. Mr. Hanks, the chemist, says:

I find this water to be remarkably free from impurities, as the following statement will show: The water is transparent, free from color, containing but a small quantity of suspended matter, which quickly subsides when the water is allowed to stand; it is very slightly alkaline, and a portion of the fixed ingredients is in the state of bicarbonates.

A microscopic examination shows the supended matter to be principally vegetable, and the forms revealed are those common in good water when it is allowed to stand for a time in reservoirs or tanks.

The total fixed constituents in this water were found to be 11.08 grains in one United States wine gallon, which is equal to 13.3 grains in one Imperial gallon, 0.190 grammes to the litre, and to 19.0 parts in 100.000.

The hardness is equal to 3.7 grains of carbonate of lime in an Imperial gallon, or 5.29 parts in 100.000. From organic matter, both in the form of ammonia and albuminoid matter, it is singularly free, showing only traces.

The contituents found, and which it was thought unnecessary to determine quantitatively, are as follows: Carbonic acid, chlorine, phosphoric acid (trace), boracic acid (trace), iron, lime, silica, soda, and magnesia.

As the result of my examination I have no hesitation in pronouncing this water to be good and in every way fitted for domestic use. It is remarkably soft, free from sulphate of lime, contains only a small quantity of fixed ingredients, and is free from mechanical impurities, which properties render it in every way suitable for manufacturing purposes.

[SEAL.] HENRY G. HANKS.

APPENDIX.

[While the Board of Health approve generally of the papers presented by contributors to this Report, they cannot be considered responsible for the opinions expressed.—*Board of Health.*]

ON THE DANGER FROM PESTILENCE IN CALIFORNIA.

BY HENRY GIBBONS, SR., M. D., PRESIDENT OF THE STATE BOARD OF HEALTH.

There are a number of diseases which appear to be carried from place to place by commerce and travel, and the possible importation of which in California is a cause of apprehension and alarm from time to time among our people. These are Yellow Fever, Malignant Cholera, Small-pox, and Leprosy. To what extent we are in danger from the introduction of these diseases from abroad, appears to be a fit subject for presentation in the report of the State Board of Health.

1. Yellow Fever—There is nothing in the laws governing the movements of Yellow Fever which would prohibit absolutely the introduction of the disease, and its prevalence in the centers of population, in the interior of the State. But the barriers to its introduction are almost insurmountable. Two methods of transportation are recognized, viz., persons diseased, and fomites or infected articles. These could enter only by ship or by the transcontinental railroad. Entrance by ship involves a voyage round the Horn, which would be, in itself, disinfectant. Even if it were not, and if vessels should arrive with the germs of the disease on board, our ocean climate would not admit of their germination. Under these circumstances there is no ground of apprehension that Yellow Fever will invade our State through the gates of ocean commerce.

It would be possible for an individual, coming from an infected district in the East, to bring the seeds in his system, so that the disease might be developed after his arrival in California. The infectious germs might be introduced still more readily through the agency of fomites. But the history of Yellow Fever shows that something more than all this is requisite for its spread in any given locality. A certain epidemic influence is necessary—a poisoned condition of the atmosphere or of the place. The range of this epidemic influence, within which the disease is liable to spring up, varies from year to year. In some years it is scarcely perceptible, and then our southern ports are nearly or entirely exempt. Sometimes it operates with so little force as to be restrained and almost disarmed by sanitary measures. At other times it assumes great virulence, and cities are devastated in spite of every human effort. Occasionally it extends far beyond its ordinary geographical limits, as it did in the latter part of the last and the early part of the present century, when the scourge almost decimated the population of Philadelphia, and even invaded the ports of New England. Such aggravations of the malign influence are likely to recur in the year following, and sometimes in

the third year. We notice this fact or law in the recent history of the disease in the Atlantic States.

If Yellow Fever, in one of these exceptional aggravations, should extend up the Valley of the Mississippi and invade the States on the line of the Union Pacific Railroad, gaining a foothold in the cities and towns of Missouri, and Kansas, and Nebraska, there would be ground for apprehension on our part. But until such a demonstration takes place, we have nothing to fear. Even then the sanitary measures which would be adopted by the State Board of Health, in coöperation with the civil authorities and the officers of the railroad, would, in all probability, ward off the evil. Such a case, however, is hardly supposable. The disease is not in the habit of leaping overland from place to place. It requires time to travel. It never appears until late in the summer in the extreme south, and before its epidemic wave could extend far towards the northwest it would be arrested by the frosts of the northern latitudes.

2. Malignant Cholera—So far as importation is concerned, Malignant or Epidemic Cholera may come upon us from various directions—from Asia, from the Pacific Coast southward, and overland. From Asia we need not fear it. The law of its extension prohibits its travel eastward. Hitherto, from its first invasion of America in 1831, its course has been westward, and its advent on our continent has always been from Europe.

Like Yellow Fever, Epidemic Cholera requires for its extension something more than human travel and commerce. There must be a certain epidemic influence in order for its migration. Having a permanent home in India, it travels abroad only under cover of that mysterious influence. It has been introduced in California several times, but has propagated itself only once, viz., in the autumn of the year 1850, when its introduction was attributed to immigrants crossing the plains. But the disease prevailed at the same time, or, rather, earlier, at Acapulco, when there were no immigrants to bring it, and no vessels arriving with it on board. The choleraic *cloud*, so to speak, had gradually spread across the continent, and established on the Pacific Coast the peculiar climatic or other conditions, without which the disease was incapable of propagation.

In the summer of 1850, the writer came from Panama to San Francisco on the steamer Republic, stopping at Acapulco and remaining there three days to procure coal and provisions. The Cholera was then prevailing there with great fatality. This was about the middle of August. The passengers, some four hundred in number, had unrestricted intercourse with the shore, and most of them spent a great part of the time in and around the town. At the request of the Alcalde I visited a number of the patients, and being familiar with the disease, could not be mistaken in its identity. Notwithstanding all this exposure on the part of passengers and crew, not one of them contracted the disease. Had they remained there a few days longer it might have been different. The seeds may have been carried into the ship, but as the vessel immediately passed away and out of the epidemic cloud they were not developed.

The same great morbific wave which crossed the continent from the Atlantic side to the Pacific Coast, at Acapulco, spread itself to the northward also, and reached California a few months later, apparently traveling with the overland immigration. A number of mining camps in the northern section of the State were invaded by the Chol-

era in the summer and early autumn, and the City of Sacramento suffered terribly by its visitation. But although there was free and constant intercourse between San Francisco and the interior, at least two months elapsed before its appearance in the metropolis. Here it prevailed mostly in November and December, disappearing about the end of the latter month. The climate of San Francisco was unfavorable to its extension, the mortality from it being only one hundred, whilst in Sacramento the number of victims amounted to a thousand.

In subsequent years Cholera was several times brought into San Francisco by steamers and sailing vessels from the southern coast, and though no especial care was observed to guard against it by quarantine or otherwise, in no instance did it communicate itself to persons on shore. In the summer of 1854, a steamer from Panama brought six or seven cases, which were immediately carried to the City Hospital, then under my charge, located in Stockton Street. They were all in the advanced stage, and nearly all died within forty-eight hours. They were placed in a room apart from the other patients, of whom the number was about 150, but no other protective means were used. The disease confined itself entirely to the cases brought from the ship, not an individual among nurses, attendants, or other inmates of the hospital contracting it.

All experience goes to demonstrate that both Yellow Fever and Epidemic Cholera are intimately associated with local impurities and filthy modes of living, and may be warded off to a great extent by sanitary measures rigidly enforced. The danger from these fatal scourges lies at home rather than abroad.

3. Small-pox—In nearly all the large cities of the world cases of Small-pox occur from time to time. The disease is a constant presence in most of the principal cities of Europe; but only when an epidemic influence favors its extension is it liable to assume formidable proportions. From commercial centers and large sea-port towns it is impossible to exclude it. Individuals exposed to its infection, immediately before departing from the East for California, would arrive here apparently in perfect health, but in a few days might develop the disease. Its periods of epidemic outbreak are not definite, though they usually recur at least once in seven years. In the interim, when the public mind is free from fear, people neglect the only means of protection, and the materials accumulate to feed the next epidemic. So it will be until vaccination shall become universal. Compulsory vaccination is the only remedy. In European countries it has been adopted with eminent success. It is founded on the duty of self-protection. Every unvaccinated individual endangers the health and lives of others during the prevalence of Small-pox, or when it threatens an invasion. This principle is recognized by our State legislation in regard to children attending the public schools. The history of Small-pox proves that we have the means of protection from it at home, and that it is idle to attempt to secure immunity from it by guarding against its importation in ships from Asia or elsewhere, or its introduction by railroads or other inland channels.

4. Leprosy—In regard to Leprosy little need be said. There is not, nor has there ever been, the least reason to fear its diffusion among our people. Unwisely, if not dishonestly, efforts have been made from time to time to alarm the public mind with the idea that we are in danger of an invasion of the disease through the Chinese

immigration. The President of the State Board of Health ha received, from intelligent persons in the Atlantic States, earnes inquiries whether our nation is likely to be inundated with th plague of Leprosy, as might be inferred from certain statements pub lished in California. Whatever may have been the loathsome and dangerous character of the disease in ages long gone by, it has lost its terrors in modern times. The best authorities all over the world agree that it is not contagious or communicable under any ordinary circumstances, and that it is propagated only by inheritance. In fact, it appears to have been dying out during the last centuries, and is now scarcely known except sporadically in a few countries, and as an endemic in some isolated localities. From the settlement of California thirty years ago, and the immigration of the Chinese at the same period, individual cases have been observed among the latter. But no disposition of the disease to extend itself has been manifested, and it is a question whether a single case of genuine Leprosy has been known in a Caucasian subject during that time. Certainly there is no proof that any white person has contracted the disease from a Chinese leper.

In conclusion, the following propositions are offered as strong probabilities approaching to demonstrated truths:

Proposition One—Yellow Fever will not invade California from the ocean. It will not spread by the introduction of individual cases overland. It will not become epidemic without an approach, more or less gradual but distinctly marked, in an epidemic form, in the towns and cities lying between the Valley of the Mississippi and the Pacific Coast. As it is not only arrested by frost, but driven back, as it were, to its winter quarters on the Gulf of Mexico, whence it must start afresh on its march the next year, the epidemic wave will never have time to make the transit of the continent so as to reach California before its arrest by cold.

Proposition Two—Epidemic Cholera may be brought into the State both by land and water. It will not spread without the presence of the epidemic influence. The approach of that influence will be noticeable in the breaking out of the disease to the eastward. As long as there is no Cholera in the Mississippi Valley and in Mexico we need not apprehend it here. In any case, it will never prevail severely in our ocean climate.

Proposition Three—Small-pox may be introduced at any time, both by sea and by land, in spite of all precautions. Judging from the past, we may expect it to become epidemic within two or three years. When it begins to spread, nothing short of universal vaccination will arrest it.

Proposition Four—As far as regards the Caucasian population, Leprosy is a mere phantom.

Proposition Five—Quarantine, however needful, is an uncertain protection. As far as it diverts attention from causes of disease at home, it inspires a false security, and does harm. The true defense from pestilence in every form lies in the care of our own dwellings and their surroundings. The people must be educated in the laws of health; and those laws must be enforced by official authority, if necessay.

Proposition Six—Boards of Health, local, State, and National, when [illegible]ly organized and sustained, are an invaluable protection to [illegible]life, and every citizen should feel that they are as necessary to [illegible]ublic welfare as a guard of police or of soldiery.

DRAINAGE AND SEWERAGE.

BY F. WALTON TODD, M. D., MEMBER OF THE STATE BOARD OF HEALTH.

In the larger towns of California much enterprise and large sums of money have been expended in providing necessary public buildings and charitable institutions; an adequate and cheap supply of water; protection against fire, that scourge of all our towns; the grading and paving of streets, and police requirements. These wants are of such prime necessity that under our expensive system of local government they are not only apt to but positively have prevented that consideration which is due to the sanitary condition of all places where even a few thousand people are collected in a limited area. Health being the rule, and disease the exception, in our favored climate, has withdrawn public attention from the possibility of our towns, or cities as they prefer to be called, ever suffering from those fearful visitations which afflict older communities, who have, like ourselves, been regardless of the means necessary to preserve health until the warning voice of the sanitarian has come to be regarded as an appeal of some impecunious doctor without a *clientele*, wanting a situation that pays, or science-struck abstractionist, who with his microscope and means of chemical analysis sees forms that to him are magnified into "gorgons, hydras, and chimeras dire" in all the simple elements that furnish food or drink to man; and yet the practitioner of medicine almost daily hears, "Doctor, I would rather give you fifty dollars to insure me from being sick, than five to make me well," from people who not alone contribute nothing towards keeping themselves and their neighbors well, but will absolutely expend an astonishing amount of time and trouble to "get even," as they call it, on the member of the local Board of Health, who, serving gratuitously on the Committee on Nuisances, asks him, in tones that imply a favor sought, to clean some disgusting vault, or remove a nasty pig-sty, that his own sense of decency should have prompted him to abate unasked.

Then, communities engaged altogether in the pursuit of money cannot well understand how any class of men should unselfishly give their time and take trouble without compensation, especially when the thing to be done operates against their own interests. The efforts of the sanitarian are consequently regarded with distrust or indifference where they are not thwarted, his advice in matters which he has carefully studied is disregarded for that of some ignorant but officious politician, who has an interest to subserve, until misdirected efforts result in harm, where good results might have followed intelligent action. This is apt to be the case in new towns. A drain is made from somebody's hotel, and another from a livery stable is allowed to connect with it, and so on until an interest is established that has weight in a Common Council, and thus, from step to step, a system grows up altogether vicious, which sooner or later, and always after large sums of money have been spent, has to give way to

another, the work of a competent engineer, but not until some serious damage has been inflicted, which the engineer, Board of Health, and Common Council combined cannot repair—as in permitting the entire garbage of the most populous part of Stockton to be emptied into Stockton Channel, an estuary without a current, little affected by tides, and incapable of being cleansed when it shall have reached a point of super-saturation and become a pool of festering filth, around which the city is built, and over which the daily and nightly trade winds of summer unceasingly blow, to carry the fetid exhalations into the houses, breeding zymotic diseases, or form a nidus for some imported pestilence, like cholera, which is now said to be prevalent in Japan, and might so easily be brought in some of the crowded cargoes of Chinese monthly arriving at our ports.

The writer has made ineffectual efforts, in the town above named, to have a small tax levied specially for drainage and sewerage, and he thinks it the part of wisdom for the Common Council in all our towns to set apart a fund for this purpose, which should be used first to secure a plan, drawn by the most competent person, and afterwards from time to time, as the fund will admit, to carry out that plan. A little work done each year upon it would soon present a system that the community would take an interest in extending, which no new community would feel able or willing to execute at one time, and it should be carried out under the direction of the Board of Health.

It is not an easy matter to get systematic work, for some remote good, done by communities who think of science as Dogberry did of reading and writing, that "it comes by nature;" and it becomes discouraging when the authorities stultify themselves by placing on Boards of Health men who take no interest in sanitary matters, who have not the necessary training or education, whose whole time is occupied in an endeavor to trick the community into the belief that *they* have been vouchsafed some occult knowledge not revealed to common mortals, and whose combined fraternity never made a discovery or established a fact of value in the cure or prevention of diseases.

There are some general laws of universal application in the sewerage of towns, as well as in their drainage, such as the separation of surface water from the sewage; the relative caliber of sewers to their contained matters, present and prospective; and the form best adapted to the grade; their ventilation; the obtuseness of all angles; and facility for passing unobstructed their contents. And there are specific requirements depending on the topography of towns, the conveniences for flushing, and the disposition of the sewage, for all plans are fatally defective which do not make ample provision for the latter. In some cases the main stem may find an outlet where it would be unobjectionable in others; in others, it would be necessary to convey it into reservoirs, from which it could be pumped into pipes and carried to where it would be useful for fertilizing soils, or dropped into running streams, whose waters are not and will not be used for domestic purposes, as at Stockton, at San José, and at Petaluma, at Antioch, Benicia, and at Vallejo.

Towns cannot begin too soon to establish their systems of sewerage. It is the worst policy to wait until the soil becomes saturated with excrementitious matters, for there is no process by which it can be depurated. It is equally bad to wait for individual interests adverse to a plan of general utility to spring up, for these must be combated,

sometimes at great expense, or engrafted upon the plan permanently adopted, often to its prejudice, if the latter is done; besides, it would be much less expensive to construct sewers through a virgin soil than to have to excavate under or through the brick foundations of buildings laid in cement. Every consideration, in fact, points to the great advantage of adopting early a plan and systematically working to its fulfillment; and no plan should be accepted until it has, at least, been supervised by a competent civil engineer, who has surveyed the ground, accurately determined the grades, and furnished estimates of its cost.

REPORT ON ABATTOIRS AND PUBLIC BATHS.

BY A. B. STOUT, M. D., MEMBER OF THE STATE BOARD OF HEALTH.

REFORM OF SLAUGHTER-HOUSES.

San Francisco, June 21st, 1879.—At 7:30 A. M. I started to visit the butchery establishment on San Francisco Bay, near West Berkeley, and the bathing establishments of Alameda. The morning was rather foggy; a brisk west breeze blew in through the Golden Gate. We arrived at 10:15 at the abattoirs by the railroad which passes on the east border (lee side) of the extensive slaughtering works which here skirt the margin of the bay. The abattoirs are built on a bluff, about fifteen feet above the sand beach. It was nearly dead low tide, the beach underneath the slaughter-houses being left perfectly bare. The beach under the works, from which the water had receded, was as perfectly clean and clear from offal as though immediately over it were no extensive swine pens nor active abattoirs. The swine are kept there on a platform, slightly dipping seaward, with troughs to receive the blood and water which flows from the felling platform eastward and on a higher level.

This shows that no more favorable conditions for an inoffensive abattoir could be demanded. But forthwith the parasite appears, the persistent fat-tryer sets up his greasy boiler.

From the moment the railroad bridge, near the works, is passed, the atmosphere, which travelers on the road must breathe, is saturated with the odors which try men's stomachs. Marshall's respirator, unbecoming indeed to ladies' faces, becomes an indispensable luxury. The adjacent land is now unoccupied, and will remain so if this objection continue. It is a killing cloud on title. The railroad brings all the cattle to the fine inclosures for their reception and their rest from fatigue, with best of fodder and water for their relief, and cannot be dispensed with, the public comfort and health to the contrary notwithstanding; but the "trying" nuisance may be abated. It is no use to say to struggling industry, "try on, try ever;" in this case we must exclaim, let us stop trying.

July 11th—Visited the beef and sheep abattoirs of Butchertown, and met ex-Supervisor Shrader, who with utmost courtesy showed up everything—also the abattoirs of Lux & Miller. Unless we except the great "Mardi Gras" of the French, when the great competitive match to produce the fattest meats is entered into, it would be difficult to find, in any country, a finer exhibition of products on an average day for the diurnal supply of a city. The rapidity of execution, and the perfectly practical and cleanly performance of all the work, could not, we believe, be excelled. Unfortunately for our disposition and duty to find fault freely, but fairly, the tide was high and the wind blew a moderate gale; yet from the moment we passed Gray's Station, on the Long Bridge, the air was redolent of coming scenes and perfumes. We might have exclaimed—a respirator, a

respirator, our kingdom for a respirator! But this was high tide with a strong sea breeze blowing; but we were informed that there was a tide in the affairs of men, which, if taken at low ebb and nor'-western gale of Araby blowing, that the atmospheric pressure on the olfactory nerves would lift off the hat from our head.

Several years ago, when a sharp and protracted contest was going on between the people and the butcheries at Mission Creek, to effect the removal of the latter, we set forth a systematic method by which to sanify butcheries wherever located. The views then expressed still merit republication and adoption. The abattoirs were removed to their present location. Large tracts of land in the center of the city have been restored to habitation and increased taxable land. But, although a great amelioration was obtained, the butcheries have only been partially improved for want of a general jurisdiction and uniform system of conducting the business. The nuisances have not been suppressed, but transferred to another locality Gardenville, in a word, all South San Francisco, is becoming unhealthy and uninhabitable. In certain conditions of the atmosphere, the Roman Catholic Orphan Asylum is inundated with the pestilential odors, and either the butcheries and their attendant still greater nuisances must be invited "to go" again, or be induced to adopt, or forced to inaugurate, a new system. If they will reform, they do not need to go. The beef and sheep butcheries are the least offensive—the swineries are much more intolerable—but worst of all are their parasitical attendants, the tallow and lard tryers, the glue and soap makers, and all the variety of makers that live on the "material" they obtain from the abattoirs. At present each throws the blame on the other. The suffering community is rather disposed to exonerate the butchers. But together they care but little for the suffering community, and should together be held responsible. While the butchers remain the others will stay. If they go, the others will move off with them. If all the tryers of fats, etc., etc., were compelled to do their boiling under domes fitting closely to their boilers, and the vapors were carried through iron cylinders heated to redness, involving but little expense, their stinking, death-dealing effluvia would be destroyed. As it is, it is worse to go through their midst than for land folk to go to sea.

THE LOCATION AND CONSTRUCTION OF ABATTOIRS.

EDS. TIMES: I observe among those who protest against the location of the abattoir at the foot of Webster Street, the names of gentlemen who reside so far from the scene of operations that their fear of pestilentive odors must be the only ground of their remonstrance. But those gentlemen and all the public may be assured that as far as noxious emanations from the abattoir are involved, they may remain unconscious of its presence, nor will their lands depreciate in value. If they wish to know of the abattoir they must search for it. If I believed their homes or their lands would be thus rendered disgusting or unsaleable, I certainly could not so far forget the proprieties of life as to advocate the location. There is no idea of partiality in the proposition, for the time will come when, like Paris, San Francisco will furnish its inhabitants from abattoirs in the southern and western parts of the city, as well as from its northern extremity. But these will be inodorous, and harmless as any other vast operation which supplies on a large scale the unavoidable necessities of the people. The signatures of those who favor the northern location are more numerous than of those who protest, and their united interest is very great.

Where populations are great and dense, they must live by systems. Combined and often complicated methods will overtop individual efforts. Companies with costly apparatus will overwhelm private enterprises. If in union there is power, the truth of the maxim will be realized in these great works of humanity. The machine bread-maker will feed the people cheaper than the private baker. Steam laundries will break the manufacturer of wash-boards; and the abattoir, with its instantaneous manipulation by scientific and economic processes of all its material from hoof to horn, will anticipate decomposition and provide a healthier, cheaper, fatter meat to the people.

The consolidated slaughter-house system recommends itself to public adoption by the fact that the large capital required for its construction insures for it a directorship of competent trustees to enforce the strictest order and cleanliness. The false economy, the selfishness, the ignorance of one set of individuals cannot throw odium on the honest dealing and liberality of another. As a system, all its parts must operate continuously and in harmony, because the profits of all its parts are derived consecutively one from the other. As regards the dreaded effluvia, which are the gaseous products of decomposing organic matter, they cannot occur, for those substances are utilized before decomposition commences. In fact, these gases are too valuable to be lost; they are employed in the combinations of useful products, by anticipating their evolution in the form of noxious gases. Twelve hours suffice to convert the living animal into a variety of conditions preparatory to their final appearance in the form of chemical products and animal material for fertilizing the soil. Neither the atmosphere which fills the city nor the waters of the bay can be polluted by impurities, for every part and portion of the animal, from the hair to the bone, are converted into saleable and valuable products. It may even be asked if the refuse of an animal, when properly economized, will not produce more than his meat, which is sold by the pound for food. The difficulty in the calculation is that in selling by the pound bone and other parts are included, which are lost to the consumer, although paid for at the price of the dearest meat.

A general idea of the working of an abattoir may be formed from the following description: The first necessity is an abundant supply of fresh water. Many of its uses, however, may be supplied by clear salt-water; and as fresh water is scarce and expensive, the salt-water, as it arrives from the ocean through the Golden Gate, may be largely employed. Salt-water soiled with mud and the filth of the docks would not be desirable. Fresh water may be obtained from wells or from the water companies; in either case reservoirs and steam-engines are called for in distributing it where required. The land selected should be chosen, as far as possible, to obtain easy drainage, or should be graded to an inclined plane. Hence, with a copious water supply from the upper side, and sewers through the premises leading into an ample main sewer emptying into the bay below the water-level of low tide, it is easy to see that the first requirements of cleanliness are obtained. A piece of land thus selected may be entirely surrounded with a lumber or stone inclosure; or should this course be in the outset too costly, smaller spaces may be strongly fenced in. Of these the first would be for the reception of cattle on its first arrival from the country. It would be graded, or better, planked, with aqueducts leading into sewers for cleanliness; with proper water basins for the animals to drink, with sheds for their rest and protection from the sun or from the storm. Over such sheds would be receptacles for grain and fodder. There would be inclosures for different kinds of cattle, and subdivisions for the property of different butchers. The general size of such inclosures must be calculated by the monthly consumption of cattle. Through this area cars on a railroad track may pass to receive the sweepings of this court, and convey them to vats hereafter to be described. These processes are done at stated hours, and the inclosure irrigated and occasionally limed, to prevent the generation of vermin. In this manner the cattle are retained for a sufficient number of days, are well fed, and are refreshed from the heat and fatigue of their land journey, or their confinement on steamboats.

Second—The butcher now selects the animals he wishes to prepare for market. These are passed into another inclosure. Here the same general arrangements prevail—water sewerage, cars, granaries, but instead of sheds, stalls are built, in which to feed up and fatten the animals to the desired degree. Each stall has its supply of water, is inclined towards gutters for cleanliness, and is kept well limed and ventilated.

Third—Animals thus rested and refattened to repair the losses by fatigue, exposure, and privation on their journey to market, are in condition to enter the third department of the abattoir, and, commanding a higher price in consequence of their superior excellence, easily repay the apparent extra expenses of their careful keeping. In an economical and hygienic view, what incalculable extra expenses in the cost of living are spared the public by the provision of such meat. Herein, deceptions are excluded. The people know their food has undergone a systematic and legalized inspection. Neither pork, *à la* trichina, nor black meat, nor flabby, watery meat, nor veal whose mortuary report is unknown, can be distributed wholesale or by contract to inexperienced or unscrupulous caterers.

As a step of political economy, by the improved alimentation are obtained stronger men, healthier women, and more robust offspring. The third department comprises the slaughter houses. In this inclosure a series of buildings is constructed, in number according to the demand, supplied with all the appliances for cleanly and rapid butchering. Every butcher has and controls his own building, and pays rent therefor. This arrangement supposes that an association of shareholders, not butchers, holds the enterprise. If an association of butchers enter into the system, fewer buildings would be necessary. In the latter case shambles would only be needed for extra butchers, to whom the association might wish to let or lease them. Every building stands alone, with ample space on every side for light and ventilation; is supplied with fresh and salt-water—also with hot water if desired; has pipes with the necessary traps for the escape of waste water, and is provided with all appliances the business requires.

In these shambles the animals are felled. The first product, the blood, is received in proper basins, and sold to manufacturers of preserved meats. It is also useful in the arts. The animals are then suspended, decapitated, flayed, and striped. The marketable portions having been selected, all the remainder, instead of being cast into the bay or fed to swine, is immediately [illegible] into cars running on a railroad track and sent to the depot, where it is cast into

vats. The heads pass to a depository, to be there divided up according to the various uses of their different parts. The skins are forthwith washed with preservative fluids, to render them inodorous, are folded, bound up, and sent to tanneries in the country. Bones are sent to special places, according to the materials to be manufactured from them. For all these manipulations a few hours suffice.

Fourth Department—Now, Mr. Editor, please to walk with me through this grand laboratory. Firstly, you see it supplied with "all the modern improvements" to convey water, with drainage for the immediate escape of washings, and with a steam-engine to move the different mechanisms employed, and send steam and hot water wherever wanted. Here you find rooms to melt down tallow and lard, with hydraulic press to obtain lard oil. An apparatus is here to get the purified lard into tins, or to prepare the tallow for the candle-maker. In another hall you see the hides disposed of. In this building tongues are salted and hams prepared for the smoke-house near by.

Over here are steam crushers to break up bone, steam it, and prepare it for its conversion into gelatine, animal charcoal, or phosphorus. In this place hoofs, horns, cartilages, etc., are packed for exportation, or reduced to the shape most convenient for manufacture. From some of the materials ammonia, or salts of ammonia, are obtained, and here you perceive are the requisites for the purpose.

Next pass with me to this section of the inclosure. All these vats are supplied with cullers, mixers, or mangles, to reduce to one uniform mass or pulp all the offal cast in them from the aforesaid cars. The requisite disinfectants, quick lime, carbolic acid, salts of iron, etc., are added, aluminous earth enough or sand to obtain the required consistency and dryness are mixed in, and thus, with other necessary manipulations, that rich inodorous fertilizer of the soil, called animal manure, is produced. It acts more favorably upon exhausted land than guano, and probably may be sold at a cheaper rate.

A collateral advantage to be derived from this system is that to such a depot may be sent the garbage carts of the city, as well as the refuse and sweepings of the markets. These, instead of being thrown into the bay, or upon open lots, or concealed in cellars—whence putrid emanations, destructive to health, proceed—may be converted into inodorous, useful products, to fertilize the soil. A stringent sanitary law, compelling compliance, would thus readily divert thousands of tons of offal from the public sewers into more useful channels. You may cease to talk of the effluvia of an abattoir if you will, but think a moment of the villainous odors from decaying vegetable refuse which load the atmosphere of the city. An idea prevails that the effluvia from butcheries is not unhealthy nor malarious. The fine robust health of butchers is offered in evidence as proof of the fact. It must be remembered that the emanations to which butchers are exposed, and the atmosphere in which they are enveloped, are not filled with the gases of putrefaction. The air they breathe is impregnated with the vapors of fresh blood, and the aroma which accompanies the departing heat of newly felled animals. These odors are disagreeable to most people—butchers, by habit, become insensible to them—but they are not necessarily poisonous to health; yet it is not to them that butchers have to be thankful for their fatness, strength, and robust health. It is only such young men who can enter on the business. Their hours of labor compel temperance, and they live without stint on the most nutritious food. Environed with such an atmosphere they are, perhaps, shielded from a worse one. When, however, the garbage of the abattoir is allowed to putrefy, to decompose, to macerate in water, then its effluvia become as detrimental to health as any vegetable malaria producing decomposition. Water containing animal matter in a state of active putrefaction is deadly poisonous, and the air malarious which surrounds such depots.

To conclude, then, this rapid survey of the consolidated abattoir system, I have only to add in its favor, that under good legislation it may become a useful link in the chain of systematized operations for the sanification of the city. For this great object a combination system must be inaugurated. In vain may the faithful Health Officer "follow the scent." He can accomplish, good hunter as he may be, but little. The game must be bagged by a comprehensive system.

The four departments into which I have divided my description may be so far divided as to be independent, but it is only to be remembered that offensive effluvia are evolved from the decomposition and putrefaction of organic matters, and that it is only necessary to intercept this process to anticipate it by the application of other chemical processes, and you may establish an abattoir in any convenient situation.

ARTHUR B. STOUT, M. D.

PARIS SLAUGHTER HOUSES.

They are located in La Villette, one of the outer wards of the city, just at the edge of the fortifications, where their odor cannot be offensive to the inhabitants of the city proper. They cover an immense space, larger than any thirty blocks in St. Louis, and were constructed under government authority, at the city's expense, and are constantly under the supervision of a branch of the municipal government. There is a police station, telegraph office, barracks for the troops, and a small force of soldiers always on duty within the grounds, which are surrounded by a high stone wall, and divided into regular rectangles by four avenues intersected by eight rues. The buildings are all of heavy stone, fireproof, and very well built. The Jews have a separate building where they do their slaughtering, according to their peculiar religious mode, by cutting the head of the animal entirely off with a single stroke of the knife, and not

by a stroke on the head with a mallet, as the other slaughterers here do. There are a series of cours running through each building, covered with a glass ceiling, and in these cours the slaughtering is done, and the animals are dressed on wooden frames placed at regular intervals on each side of the cour. A peculiar feature of the operation, which I have not noticed elsewhere, is that of blowing up the carcass as soon as the head and legs are cut off. The body being placed on the dressing-frame, an incision is made in the breast near the neck and the nozzle of a bellows inserted. A man then works the bellows for about fifteen minutes, until the whole carcass is swollen out like a small balloon. The reasons given for this are that it makes the meat look better, more plump, than it otherwise would, and that it enables the one who skins the carcass to get the hide off quicker and easier, without injuring it. All animals, bullocks, calves, sheep, etc., slaughtered here, are blown up in this manner. The greatest cleanliness possible in such a business is observed, and the disagreeable scents are reduced to the minimum.

A novelty in pig-butchery is to be seen here on the avenue of the pig-stys, in the houses where they slaughter the grunters. The pigs are taken into a large round-house, something like a locomotive round-house in America, having a cupola in the roof to let off the smoke, the floor being divided into triangular dens. A dozen or so of pigs are driven into each den at a time. A man strikes each one in the head with a mallet. They fall down quietly and are laid in a row. Then the butcher comes along and cuts each one's throat, and a girl holds a basin under the pig's throat to catch the blood, which is all carefully poured into a large can and stirred by the girl to keep it from curdling. This blood is used in making the large, black sausages, so much sold in Paris. Another girl goes along the row and works the pig's front legs to keep the blood flowing, and twists the hind legs to disjoint them. A man then carries each porker to the side of the room and arranges them in a methodical row, heads all in line, and covers them with straw, which is set on fire, and burns off all the bristles rather more quickly, but in the same way as cooks scorch the pin-feathers off a fowl in America. The longest bristles have been previously pulled out by hand by one of the butchers and preserved for brush-making. After a good scorching the pigs are carried into the dressing-room, hung up on hooks and scraped all over by means of a sort of drawing-knife, handled by a skillful operator, who scrapes a pig in about one minute. Then the bodies are washed and the entrails taken out and cleaned. They utilize every part, even some of those which Americans customarily throw away. A ludicrous sight, as you walk down the avenues, are the long rows of bullocks' legs with the hoofs still on them, standing up against the walls of the slaughter-houses, toes out, awaiting purchasers.—*Correspondent St. Louis Globe-Democrat, July 10th*, 1879.

This statement is valuable to corroborate the above remarks. It is evident the government exercises a direct contolling power. The present confused state of imperial and republican legislation in France enables the municipality to enforce the regulations of hygiene. We do not of course here propose the impracticable, but Police Inspectors could efficiently replace the military authority. The benefit of their presence would amply compensate their cost by the improved health of the vicinity and increase of land values. Neither do we advocate the plan of exposing young girls to any such loathsome employment.

Mr. Codman, in his discussion, addressed to Congress on "Free Ships," we might say Codman vs. Lynch, remarks:

"One argument in opposition to free ships is founded upon the injustice that would be done to our own ship-builders. Were this true, it might be said that ship owners and the general public have some rights that ship-builders are bound to respect. The interests of our whole people are paramount to theirs." (See Economic Monographs, No. VI, page 19.)

This idea is perfectly applicable to our butchers and their dependent families, the fat makers, etc. They demand protection, because the community depends upon them for beefsteaks and chops. But if they disregard all the interests of the same community upon which they in turn depend to buy their chops, then they forget, in truth, their own interest, and become reckless of every interest except their own personal profit.

BATHS AND BATHING.

This subject asks for brief mention. Aware that it does not come within the limits of legislative action, except indirectly, we may,

notwithstanding, reach the public mind through the appeal to the State Executive on important matters of general hygiene.

The Bay of San Francisco as a salt-water bathing resort is steadily increasing in importance. On the north shore of the peninsula are four large and well equipped bathing establishments. At Alameda are five private bathing institutions, most admirably supplied with all the essential requisites, and easily accessible from the city by ferries. For safety to the bathers of all ages and both sexes, for comfort and luxury, and, with teachers to regulate and aid in aquatic exercises, as hygienic gymnasia they are worthy of a much more extended reputation than they already possess.

To more adventurous bathers the shore of the Pacific Ocean, near the Cliff House, offers the same facilities as Rockaway or Long Branch on the Atlantic coast.

Surely did Mr. James Lick, the humanitarian, understand the principles of political and hygienic economy when he donated his bequest to public baths. All enterprises of the kind to-day are private. It is time the public, with its public resources, should, as with public schools, invest its influence and express its appreciation. To prepare the way for the reception of Mr. Lick's munificent bequest, some public action might be taken, which would associate to itself the gift of Mr. Lick, equal to $150,000.

1. To buy the site for an elevated reservoir, with pumping-works to supply salt-water and furnish the bath-house adequate and conformable to the dignity of such a bequest, together with means to pay its current expenses, could never be done on $150,000.

2. To build a bath-house, and pay the Spring Valley Water Company for fresh water to supply heating apparatus, and running expenses, could not be accomplished with $150,000.

3. To use salt-water near or at the beach, without elevated tank and costly pumping-works, would inflict a heavy cost in car tickets to transport the bathers to the bath, and hence they would not be free baths.

For none of these plans would $150,000 suffice.

Let us now inquire what might be attained by a general system inaugurated and executed by competent engineers.

A foreknowledge of the point of introduction of the Lake Tahoe water, should the Tahoe project be adopted, would greatly facilitate the site and manner of works and kind of water to be selected for the Lick Public Baths, and thereby greatly economise that fund.

The great hygienic question of the day is, undoubtedly, the water supply of the State—firstly, for the large cities; secondly, for irrigation of lands; thirdly, for mining purposes. Of the cities, San Francisco is in the most urgent necessity. The route from Lake Tahoe to San Francisco is the most central, touches the most cities and towns. The water of the lake is unsurpassed for excellence, and certainty of never-failing supply. Had the work been commenced when first projected it would now be completed. But too many projects were in the field, and speculation so rife that it defeated itself. With an abundance of pure water come cleanliness, health, long life, and happiness. One would think that water like air should be free to man. Let the people at least have it without stint, and at almost free rates. (See report of A. W. Von Schmidt, 1871.)

A glance at the natural water supply of the State, as well shown on the accompanying map (see report on the Water Supply of San Francisco to the Water Commissioners, by Colonel Mendell, 1877), will convey the idea of a most perfect system. No State in the world can present such a view. On the eastern boundary the Sierra Nevada appears as a vast water-shed, with an elevation which overlooks the entire domain. A vast embranchment of rivers, with their innumerable forks, pour the mountain waters into two great confluent streams —the Sacramento from the north, the San Joaquin from the south. At their junction in the interior of the country commences the magnificent main trunk, which, flowing westward through the middle of the State, sweeps majestically through the Golden Gate into the Pacific Ocean.

Again, high in the Sierras on the eastern limit of the State is that master-work of nature's grandeur, Lake Tahoe, the consummation, par excellence, of an Almighty project to fulfill the destiny of a favored people; a reservoir not made with hands, whose masonry is imperishable; whose crystal waters, fresh distilled from heaven, need no meter to measure its economy, but lives there, its fertilizing dews giving birth to luxuriant forests, and in the silent but persistent eloquence of nature's voice inviting every man and every acre in the State to draw upon it and quench their thirst. It seems as though the Almighty Engineer, foreseeing the coming events, had taught the plan and, forsooth, almost executed it. Certainly has He executed and bequeathed the most costly sections of His vast intention. Nor is interest charged withal upon any bonds. But yet we linger and gaze and thirst, but accept not the proffered boon. Shall we wait upon the shore until the whole stream has passed by?

Let us suppose that under a dire necessity we were compelled to build a reservoir like the Lake Tahoe, no petty soluble, leaking, cracking, water-tank is it. What might be the cost of the work and the time to construct, the bonds and the interest? Yet we have it for the taking at only the cost of tapping; we dally with time and take it not. Before such advantages to the State, two-thirds of the cost already paid in as nature's free bequest, in our view, these natural resources should at once be applied regardless of the millions to be expended; while on the other hand, if we compute the actual revenues in coin, the saving of life in hygienic ameliorations, the preservation of property from conflagrations, the increase of the production of cereals, the greater certainty of crops, the greater products from hydraulic mining, and finally, the sanification of cities and towns would compensate most amply any investments.

In conjunction with such a work, we would most respectfully suggest another reform. At present there is much discontent in regard to the employment of prison labor. While manufacturers complain, it is evident that fifty cents per day for prisoners' work is underrated. This labor, if expended on such a public work, would become worth more than double to the State and the political objections be removed. This subject, however, not being strictly of hygiene, we do not seek to pursue it.

PUBLIC GYMNASIA FOR THE IMPROVEMENT OF YOUTH.

Gymnasia for the maintenance of health and inculcation of good manners and morals are the equivalents of prophylactics in medicine,

to protect the physical system from the invasions of disease. Hence, the cultivation of health and physical vigor, by the use of gymnasia, is as legitimate a subject to be entertained by the State Board of Health as is the introduction of ozone as a protection against malaria, or the construction of sewers to disinfect a city.

Mens sana in corpore sano is an old definition of perfect health, but the essential element of this state of beatitude is the *corpus sanum*, a sound body. Without healthy physical tissue, blood, brain, bone, muscle, there can be no truly sound intellect. The development of mind is consecutive to the evolution of body. As the body is built on the true principles of physical architecture, under the control of accomplished architects in nature's laboratory of man, so in its turn will evolve the educated mind to adorn the temple.

The statue of clay was first molded, and the vital spark of life was then breathed into its nostrils. To procure, then, exalted intellect and pure morals, first construct your statue right. The ancient Greeks well understood these principles of physiology and the dependence thereon of psychological evolution. To their practical application the Spartans owed their deliverance from the Persian army. The gymnasia of Greece were the pride of their educational system. Even the women were required to obtain proficiency in calisthenics, for it was a law that no young woman could marry until she had given some public proof of her physical perfection. Under such an educational regime we hear of the Spartan mother saying to her son on his going forth to battle, "rather be brought back to me on your shield than return unworthy of your country."

Xerxes' army was vanquished, and Greece was rescued.

The establishment of gymnasia in Germany is of an ancient date, and they have now become, after many vicissitudes, like a north star in her intellectual firmament. They were constituted as second class schools, between the primaries and the universities—an intermediary rung in the scholastic ladder. Originally they were instituted by the clergy as "cloister schools," but subsequently, after the Reformation, they were secularized, and now exist under the Empire as independent teachers of secular education. And they now preside in Germany as the arbiters between the liberty of free thought and the education of theocracy.

Now, we are one of the many who believe that the women of America are as noble and courageous matrons as the best and purest of Helenic production. We feel assured that the incorporation of gymnasia in our public school system would meet with their entire approbation, and prove an invaluable relief and aid to them in rearing their offspring.

In the report of the State Board of Health to his Excellency, Governor Irwin, in 1878, page 11—Report on Prison Discipline—recommending the introduction of an educational police to oversee the discipline of the public schools, as regards the good behavior of the pupils out of school and on the streets, the following extract is presented:

Secondly—An extension of the power and authority of Boards of Education, and the creation of a reformatory educational police for minors or juveniles. Such supervising agents should be entirely distinct from the municipal police, under the direction of a tribunal of the Board of Education, and with power to make arrests—such arrests to be considered as only corrective, and divested of the intention of criminal prosecution. Such a tribunal, therefore, would be the first corrective step to warn the unruly and the unwary of their danger—in a word, the primary correction of "hoodlumism." The officers of this force should wear a distinctive uniform,

but different from that of the municipal police. Boards of Education would thus hold a corrective court, before which juvenile delinquents would be arraigned; *their parents cited*, their home discipline and education looked into, the facts recorded for future reference, and such reformatory counsel given to both delinquents and parents or guardians as would tend to prevent a recurrence of arrest or complaint. Here, then, would be a tribunal to which parents, whose children, from bad outside influences have become unmanageable, would have recourse for aid to assist their discipline.

We would not inveigh against San Francisco, in its general average of good versus evil, as compared with other great and overcrowded cities, but experience teaches that the profanity and indecent language of the street boys of San Francisco is monstrous and disgusting. It is fast surpassing the power of individuals to control. It penetrates the interior of the best families, and frustrates the best directed efforts of intelligent homes to maintain parental discipline and home education. The beautiful lessons of home are annihilated by the damning influences of the street. However we may seek to apologize for ignorance, and exonerate recklessness from blame, it is the lowlings of the street who corrupt the purity of our race and thwart education of its harvest with a withering blight. Hence a popular, universal, and legislative intervention is demanded. The shield of universal education, guarded by universal love and beneficence, can cover and protect this emergency. The enlightened people of our State will appreciate its merit, will recognize its utility, will see economy in its enactment, and public opinion will defend it.

The plan above proposed will place the whole matter under a legislative jurisdiction.

We hope not to appear importunate if we still continue to urge this suggestion.

Here appended is a description of the new gymnasium just opened by the Olympic Club, to show the perfection which the gymnastic arts have attained in San Francisco, taken from the Alta California, January —, 1879:

THE OLYMPIC CLUB—OPENING OF THE MAGNIFICENT NEW CLUB-ROOMS AND GYMNASIUM.

The new rooms of the Olympic Club were thrown open to the members yesterday, and were visited by large numbers of ladies and gentlemen, who had the pleasure of seeing what is claimed to be the finest gymnasium, not only in this country, but in the world. The members of the club, for some years, were dissatisfied with the location of their rooms, which were on Howard Street, at the corner of New Montgomery. In June last they made an arrangement with Mr. Barron, the owner of the property known as the Morton House, which had been vacated, and leased it for ten years. It is central in its location, and has a frontage on two streets, Post and Morton. The size of the lot is 100 feet on Post by 127½ feet deep. The original building was three stories, and was cut into small rooms and hallways. As soon as the property was secured Mr. Barron raised the building some nine feet, to make the stores on the ground floor higher. The Club have the rest of the house, and, under the direction of Mr. W. S. Lawton, the whole of it was torn down, leaving only the bare walls. A large number of workmen were employed, and everything rebuilt of the best material, with the sole idea of making the gymnasium as near perfect as possible.

The entrance to the rooms is on Post Street, and the main hall takes up the whole of the front on that street. This is a large, light, and airy room, 57.6 feet wide by 97.6 feet long, and 35 feet high. The roof has a large skylight, with ventilators, and is hung from the walls by heavy truss girders. The floor is laid of the finest timber, and is filled in below with cement to stiffen it and to deaden the sound. Around this room, about half-way up, runs a gallery six feet wide, built especially for running or walking, and it is covered with finely corrugated rubber, making a good resemblance to a turf track. The ends are raised on the outside, so that in turning the sharp curves the runner will be kept from being thrown off his balance. This can also be used as a balcony, and seats can be put there without trouble. It is reached either from the main floor, by two spiral stairs, or from the floor above. A row of benches on the main floor separates the gymnasium from the fencing and sparring hall, which is 40 by 75 feet. In this room are the lifting machines, dumb-bells, and other apparatus.

On leaving this room and entering a hall running east and west, the visitor comes to the main parlors, which front on Morton Street. There are two rooms, with folding doors and beautifully furnished. One has tables covered with papers and magazines and is to be used as a reading-room. The other is for public receptions and is fitted up with the most elegant furniture. Both these rooms are lighted by large bay windows opening on Morton Street. All the details of the rooms, the carpets, hangings, and chandeliers, are elegant and worthy of any residence. The taste of the ladies who have been consulted in these arrangements is unsurpassed. Ascending to the floor above by a broad stairway, the whole front on Morton Street is devoted to the billiard and chess-rooms. There are three new tables, with racks and cues, and in the chess-rooms are tables for eight or more players. Across the hall, which runs the whole length of the building, is the members' dressing-room. This lies directly over the fencing-room, and is about the same size. In here are bath-rooms, warm and cold water, showers and sprays, the private lockers of the members, water-closets, etc. There are also three rooms

where hot and cold baths can be taken at any time, and besides there are plenty of mirrors and all facilities for completing the toilet.

A feature of the gymnasium is the addition of a steam laundry, where the exercising clothes of the athletes are sent each day, and returned to the lockers the next morning carefully laundried.

The members of this club may be congratulated on the successful manner in which everything has been carried out by President Fletcher and Superintendent Lawton. With such attractions there should be a large accession to the number already on the roll.

The President, Mr. H. P. Fletcher, being a thorough business man, and seeing that the large outlay for fitting up the club so magnificently must be met by some more rapid accumulation of funds than will accrue through the dues of members, has devised a plan outside of club control for placing a certificate of life membership within the reach of those who choose to invest the price of one month's dues in the scheme: Each month 160 numbered tickets will be issued to those who subscribe their names, and the person holding the ticket corresponding to the number drawn from a hat, will receive a life membership certificate; yearly certificates will be given to the next six on the list. Thus the club's finances will be benefited about $400 per month, and an equivalent in value will be given to the investors. A plan for admitting ladies to the privileges of the gymnasium on certain days will be discussed at the Directors' meeting.

The high road to national prosperity is attained through the devious paths of State education. A very important one of these is calisthenics.

Why should California not profit by these antecedents? They certainly come within the scope of the taxpayer's limit, and the utmost ambition of the *paterfamilias*. In fact, the State becomes the practical, essential father, while too often *paterfamilias* is the impotent factor. Having advocated the formation of an educational policy to insure order out of school, to repress hoodlumism, and to enforce the legislative law of compulsory education, we now suggest the creation of gymnasia as additional institutions to the public schools. One gymnasium could be adjoined to every school. In addition, a gymnasium might be built on every public plaza. At present, the plazas are only ornamental gardens and public ventilators. The addition of a work of hygiene could certainly do them no harm. It is the charm of gymnasia that all the boys like them. They all run for them; their exuberant spirits there find exhaustive employment. Their sports may be ever so bold, but being subject to a scientific and controlling discipline, can never eventuate in quarrels nor blasphemy. The great public benefit is that they are out of the streets, and exercise in safety. The advice and instruction they receive teaches good manners and the art to be a gentleman. Hence, gymnasia are practical schools of morals.

Enough has now been said to introduce the subject, and we respectfully present it to the consideration of the State Board of Health.

PUBLIC HYGIENE—THE IMPORTANCE OF FLANNEL UNDER-CLOTHING.

BY F. W. HATCH, M. D.

One of the duties assigned to the State Board of Health, by the Act of the Legislature authorizing its organization, is that of "taking cognizance of the interests of life and health among the citizens generally, * * * and making sanitary investigations and inquiries respecting the causes of disease, * * * gathering such information in respect to these matters as they may deem proper for diffusion among the people."

With these instructions in view, it has been considered not inappropriate to present a few general remarks in relation to some of the ordinary habits of life, especially the necessity of protecting the body at all seasons by suitable under-clothing. It seems somewhat strange, yet it is nevertheless true, that we are all of us most apt to overlook and neglect those things which are most familiar, and which, from frequent association, we are apt to consider trite and commonplace. We recognize the "weightier matters of the law," while the simpler precepts which affect every-day life are prone to be lost sight of. Of no one thing is this more true than that which is to form the subject of the present reflections.

In its consideration, it will be my endeavor to discard all nicely drawn anatomical or physiological descriptions pertaining to the skin and its functions, or to allude to them only so far as may be necessary for a proper understanding of the subject. The aim will be rather to deal with it in a practical manner, and with a degree of plainness which, while it may appear simple and commonplace to the physician, will be more likely to excite the interest and reach the comprehension of the public non-professional reader. For the benefit of such indeed the organization of Boards of Health is designed.

Yet, even for this purpose, a cursory allusion to the structure of the skin—the external investment of the body—will not be without interest. Briefly, then, the skin is composed essentially of two separate and distinct layers—first, the epidermis, or scarf-skin; second, the derma, the latter being divided into two layers or strata, or superficial or *papillary* layer, and a deep or *corium*. The former, or epidermis, is a secretion or product of the latter, hard and horny upon its external surface, and affording protection to the softer and more delicate structures beneath—the papillary layer of the *derma* with which it is in contact. It is subject to continual loss and renewal. As its exposed surface hardens under the influence of the atmosphere, it is continually being removed in bran-like scales, while new layers are constantly taking the place of that which is lost.

The *derma* or true skin is, for present purposes as well as anatomically, the more important. Through the *corium* or deep layer of this structure pass numerous blood-vessels and nerves to the *pap-*

illary or superficial structure, where they are distributed, their number, size, and arrangement differing in different parts of the general surface of the body. Commonly, they are exceedingly minute and delicate. A pin, made to enter the skin at any point, it is said, will wound one of these vessels and nerves. They are estimated at about two thousand eight hundred in each square inch.

This papillary layer, so rich in vessels and nerves, is extremely sensitive, and is readily affected by impressions made upon it through the epidermis. It plays an important part in inflammations of the skin and in the eruptive fevers, it being, in all probability, the organ or portion of the skin in which these fevers are localized or find expression. It is the seat, also, of that affection, so annoying in summer, known as nettle-rash or hives.

In addition to the vessels and nerves, we find in the *corium* certain glands, the most important, for present purposes, being the perspiratory glands—small, round or oblong bodies, having a duct or tube which rises through the derma and epidermis, and opens upon the surface of the latter by a small aperture or pore which permits the escape of the perspiration. The amount of water secreted and discharged from the body through these pores is enormous, varying with the temperature of the external air, with exercise, and with various other conditions both of health and disease.

Closely allied to the skin are the mucous membranes, forming an *internal investment* of the body, or, as they are often spoken of, the *internal skin.* The skin, *i. e.*, the *external covering* of the body, is merged at the orifices of the latter—as the mouth, for example—with the mucous membrane. At these points it passes, so to speak, into the latter, being essentially identical in structure, Thus considered, each individual layer of the skin may be said to have its representative or counterpart in the mucous membranes—the epidermis of the former in the epithelial layer of the latter; the derma, or cutis, in the proper tissue of the mucous membrane, or the corium, which is here again subdivided into two layers, *superficial* and *deep*, the latter containing, like its representative in the skin, papillæ with blood, and lymphatic vessels; and, lastly, the subcutaneous, in the submucous tissue. These two membranes, moreover, have similar offices to perform—offices differing only according to the different physiological functions which devolve upon them.

It is a fact familiar to every physician, and usually appreciated by those outside of the profession, that *sudden* changes of temperature are frequently followed by disease. We hear this recognition expressed almost daily by complaints of having "taken cold"—"this sudden change in the weather has given me a cold;" we observe it in our children during infancy, by the frequency of one form of croup, and, at all ages, by the occurrence of catarrh, or slight cough. These things are especially coincident with a change from a high to a low temperature. Such a change, even when gradual, when brought about by removal of the residence from a warm to a cold climate, is recognized as a cause of certain serious affections—the cold air acting as a depressant to the nervous system and functions of the skin and lungs, occasioning not only pulmonary troubles, exciting to pulmonary consumption in those predisposed thereto, but throwing a vastly increased work upon the internal mucous surfaces.

If these things arise from changes gradually brought about, it is

easy to perceive how much more pronounced they may be when the transition is abrupt and sudden. In the latter instance, the vessels and glands of the skin, stimulated into a state of increased activity by a heated atmosphere, are suddenly constricted; free perspiration is checked; the transudation which we have seen to be constantly going on from the surface, and which is so necessary as an equalizer of heat, and as a means of carrying off the effete products of combustion and decay, is diminished, and an unnatural tendency of the blood towards the internal organs—the liver, the pulmonary and intestinal mucous membranes, and the kidneys—which become the seat of congestion or engorgement. This is, moreover, sensitively felt by the nerves with which the skin is so abundantly supplied, other nerve-trunks being thereby excited into irritation through their connection with the former.

Applying these facts to the climate of California, our attention is directed to certain features, not peculiar to it, indeed, but sufficiently prominent to have attracted the notice of those who have studied its sanitary aspects. Their application is to certain seasons more than to others, and to certain climatic divisions of the State more forcibly than to certain others; but it is to those seasons—the summer and autumn—when the neglect of suitable precautions is most frequently observed, and to those sections and localities where the necessity of caution is seldom recognized. In regard to the latter, the inhabitants of the valleys are particularly exposed, vicissitudes of temperature being usually greater there than elsewhere; yet, upon the coast region, where northerly winds so often suddenly arise during the summer months, chilling the surface by cold mists, the influence of the same cause is seriously felt. The property of those winds of rapidly conducting caloric from the body favors a more intense sensation of chilliness.

This particular part of the subject cannot be more clearly illustrated than by meteorological statistics.

TABLE

Of mean temperatures, maximum and minimum, and at 9 p. m.; also, the ranges of temperature, and the mean relative humidity, at 2 p. m. and 9 p. m., at Sacramento, California, 1877.

1877.	Mean maximum temperature	Mean minimum	Mean temperature, 9 P. M.	Mean range between maximum and minimum	Mean range between maximum and 9 P. M.	Range 25° or over in days.	Range 30° or over in days.	Range 40° or over in days.	Relative humidity at 2 P. M. (means)	Relative humidity at 9 P. M. (means)
January	62.9	37.8	47.6	25.1	15.2	19	10	0	65	79
February	67.6	43.9	53.5	24.	14.1	15	4	0	71	82
March	72.2	48.4	56.8	21.2	15.4	20	7	0	70	89
April	73.9	44.9	57.	28.7	16.9	24	13	0	63	83
May	77.9	43.7	52.8	30.2	25.1	28	19	2	62	73
June	87.5	55.7	72.6	32.	14.9	27	20	3	50	71
July	89.5	57.2	71.2	34.8	18.3	29	27	7	56	67
August	90.3	53.2	71.7	36.3	18.6	31	29	9	58	71
September	89.1	54.0	70.4	31.7	18.7	30	26	7	53	70
October	76.2	47.1	57.4	29.1	18.8	22	18	0	55	77
November										
December										

By an examination of the above table, it will be apparent that the period of the greatest deviations of temperature between the hottest part of the day and the night minimum is during the summer months, the range of the thermometer having been 30°, or over, during one hundred and thirty-nine days out of the one hundred and eighty-four days between May 1st and October 31st, 1877; while the days on which the difference amounted to 40°, or over, were during May, June, July, August, and September, the total number of days on which this extreme range was observed having been *twenty-eight.* It is not necessary, for present purposes, that these great deviations of temperature should be uniform, occurring every day. In fact, so far as concerns the argument in favor of proper protection of the body by woolen under-clothing, it is all the more forcible by reason of this non-uniformity, for then the needful precautions are more liable to be neglected. A danger expected is apt to be guarded against; it is only when sudden or exceptional that it finds us unprepared. Even 40° do not represent the greatest deviation which the daily observations exhibited. Upon several occasions it reached 44°, and even 48°.

It can be easily understood, when we consider the intimate relation existing between the external skin and its internal representative, the mucous membranes—when we consider, also, the vascular and nervous connections which it sustains to the internal viscera—how great a shock to the system such a change will occasion with those exposed to its influence unless suitably protected; how bronchial and pulmonary disease may be excited; how diarrhœal affections may be induced; how the secretions of other organs, such as the liver or kidneys, may be deranged.

By the table is also shown the relative humidity for each month. Saturation of the atmosphere being expressed by 100, we find a decided change in the percentages between 2 P. M. and 9 P. M.—an average difference of about *sixteen* for the six months from May to October. When we consider the relation between the temperature of the atmosphere and its capacity for moisture, it will be well understood how much nearer saturation it becomes during the evening, and how much more likely, *cæteris paribus*, to be an exciting cause of disease. By a sudden fall of temperature the water of the atmosphere, existing in a state of vapor, is condensed, and is much more sensitively felt than the same amount of moisture in a high temperature.

Among other diseases than those already alluded to, which not infrequently owe their origin to the causes above referred to, may be mentioned rheumatism, particularly muscular rheumatism, and neuralgia. In cholera seasons there has often been observed a close connection between an attack and sudden refrigeration of the surface of the body. So firmly convinced of this fact were the physicians of some parts of the country during the early years of this disease, that it was the custom to recommend to the people to constantly wear a large *pitch plaster* over the abdomen, even during the hottest weather, as a protection against sudden atmospheric changes. From this same cause, also, it is not uncommon to notice an attack of ague to supervene in those predisposed by residence in a malarial district.

Bearing these facts in mind, we may readily perceive the importance of even the commonplace and unattractive subject which we have ventured to present. If every individual could change his

clothing whenever the weather changes, keeping a constant watch over the sudden transitions from heat to cold, or prepare himself for the more gradual deviations which occur as the day lapses into night, the necessity for woolen under-clothing, though not altogether removed, would not be quite so urgent. Yet, in the very nature of things—in the conditions inseparable from the business and social relations of man—such a degree of prudence is almost impracticable. Under-clothing, therefore, besides being under all contingencies the most suitable and conducive to health, becomes indispensable.

The object of clothing, as it affects the present subject, is not so much to keep the cold out as to keep the heat in. The body contains within itself, within certain limits, the means of maintaining a uniform, or nearly uniform, amount of heat. The processes of waste and repair which are forever going on in the living organism are those also for the manufacture of heat. It contains within itself a furnace forever active, continually fed by the process of respiration, and by the food ingested. The external air, when of a lower temperature than the body, is constantly abstracting a certain amount of this heat. One of the objects of clothing is to prevent its too rapid dissipation or radiation. Much depends upon the nature of the fabric, and the amount of air it can retain. All the varieties of clothing in common use are, more or less, porous—a quality depending upon their elasticity; they contain, within the fabric, interstices larger or smaller according to the materials of which it is composed. The interspaces in woolen goods are large, those in cotton next, and those in linen smaller. Hence woolen clothing is capable of retaining within its meshes or interspaces a larger amount of air, and is consequently warmer than other fabrics; hence, too, in addition to the stratum of warm air between the clothing and the skin, we have the additional protection of the air inclosed within the fabric, and this air, once warmed by artificial means or by abstraction of heat from the body, maintains a partial equilibrium between itself and the latter, and is but slowly given off to the atmosphere without (Wagner, Pathology, etc.). Moreover, this air, being heated, receives the first impression of a sudden change of temperature, and thus protects the body from a too rapid withdrawal of its own caloric. The advantage of such a protection will be evident when we consider the sudden variations of temperature to which it has been shown that the valleys of California are subject during the summer months.

Some of the principles just alluded to are important in their application to clothing when damp, as it may often become in summer by means of perspiration. We "catch cold" when the clothing is wet, because the air inclosed within the pores or interspaces of the fabric is displaced by water, and the latter is a better conductor of heat than the former, and the effect is probably hightened by the facility afforded for evaporation by different fabrics. It has been shown by experiments conducted by Pettenkoffer, that this process is much more rapid from linen than from wool. The pores of the former become almost impervious to air when wet, and the same is true of cotton and silk, while woolen fibers retain their elasticity and porosity. "It is," says Wagner, "because the air is more driven out of linen or silk fabrics than out of woolen ones that we catch cold more easily by being wet while clothed in linen or silk."

It needs no nice experiment to demonstrate the facts spoken of.

We all know from experience how uncomfortable linen or cotton clothing becomes when wet, while woolen, containing an equal amount of water, may be worn, comparatively, without discomfort.

If what has been said upon the structure and functions of the skin, and what might be called the *theory* of clothing, has been made sufficiently clear, the great importance of the subject, in a sanitary point of view, will be apparent. The principles apply to all classes and to all ages, for though some may be able to resist the common consequences of their neglect, there are few whose health would not be more assured by their observance—few so robust that they may not fall victims to imprudence. But it is to the young, to infants, upon whose sensitive organizations impressions such as have been alluded to fall with peculiar force, that the question of clothing becomes of paramount importance; it is to that large class met with in every community, youths of delicate constitution, inheriting, perhaps, a tendency to pulmonary disease, or tainted, possibly, with the seeds of scrofulosis, that this subject appeals with peculiar force. It is at this period of life, if ever, that the constitution of the individual is to be strengthened, the external exciting causes of disease guarded against, and the health fortified by every precaution which prudence can suggest. There is no greater falacy, at least as to the methods commonly adopted, and as we so often see it practically exemplified, than the prevalent idea of "hardening" a delicate organization. Two results are usually attained by it—the naturally robust *may* survive—the weak, perish; but how many of the latter may have lived, and, under more judicious physical culture and wiser hygienic management, have grown up to vigorous manhood, the advocates of the "hardening system" fail to tell us. Perhaps the disciples of Darwinism might see in it another result—the confirmation of the theory of selection.

The cautions alluded to above are especially applicable to young infants. At this stage of life the animal heat—the normal standard of heat—is more speedily lost upon exposure than in later years. They become chilled under exposures scarcely perceptible to the adult, and the effects are often noticed in the pinched features, the bluish extremities of the little creatures thus cruelly jeopardized. Yet how often do we see mothers clad themselves in wool and furs, leading their young children, clothed in garments which fashion may have dictated, but which leave the upper portion of the chest and the extremities uncovered. Is it surprising, when such indiscretions prevail, that croup, bronchitis, and pneumonia still claim their victims from this tender and susceptible age? Flannel underclothes—coverings for the chest and abdomen, and drawers or leggings for the extremities—would prove the means of averting much physical suffering and many of the maladies to which children are subject.

The clothing, in all cases, should be adapted to the temperature and its vicissitudes; it should be lighter in summer than in winter, and sufficiently loose to permit the free play of the organs, and to excite, by friction, a healthful stimulation to the skin. Such precautions are particularly necessary in windy or in damp weather; in both, there is a more rapid dissipation of heat, in consequence of the constant change of air surrounding the body in the one case, and the hightened conducting power of the atmosphere in the other.

SAN LUIS OBISPO COUNTY HOSPITAL.

[The following report of the Hospital in San Luis Obispo County, having been received after the body of this report had been made up, is inserted in the Appendix.]

REPORT TO THE STATE BOARD OF HEALTH OF THE INDIGENT SICK,

Treated in the San Luis Obispo Hospital, for the four months ending June 20th, 1879.

NAME AND LOCATION OF HOSPITAL.	Number of Months Reported	Total Admitted	Discharged Cured	Discharged	Died	Percentage of Deaths	Remaining under Treatment	Physician's Name and Post-office Address.
San Luis Obispo Hospital	4	22	10	10	1	5	11	W. W. Hays, M. D., San Luis Obispo, California.

Until within the last eight or ten years (the county being sparsely populated), there were comparatively few indigent sick, and the Board of Supervisors considered and relieved each individual case; but with increasing population the demands for public charity became more frequent, and it was necessary to adopt some more permanent plan for relief. After various experiments a contract was made with a physician, who was to attend professionally, board, and furnish medicines to the indigent sick for two dollars and a half per day each. After some time (about two years), the contract price was reduced to one dollar and a half per day for the sick, and eight dollars per week for convalescents. This was in force when the new hospital was opened. Paupers, not sick, were boarded out at from five dollars to eight dollars per week.

In the meantime the Board of Supervisors were taking steps to secure for the indigent sick such permanent relief as increasing population and advancing civilization made necessary.

In the year 1869 the United States Government granted to the Town of San Luis Obispo a patent for a certain number of acres of land for "the benefit of the actual occupants." At that time the county was in possession of two blocks of land, on one of which was an old building used as a Court-house, and on the other a Jail. These two blocks were deeded by the town to the county. In the year 1873 the county purchased another lot and erected thereon a new Court-house and Jail, and when the new buildings were completed the Board of Supervisors ordered the old county property to be sold, and the amount received from the sale to be set aside "for the purpose of forming a fund to be used in constructing a County Hospital." The amount realized was $8,225 15, with two lots still unsold. This money was subsequently *borrowed* from the Hospital Fund, placed

in Current Expense Fund, and expended. Nevertheless, the amount is justly due to the Hospital Fund, with interest. Last year, 1878, the Board of Supervisors decided to erect a hospital, and appointed a committee, consisting of Mr. C. W. Dana, Dr. French, and myself, to adopt a plan, and afterwards to superintend its construction. After its completion the Board appointed a committee, Dr. French and myself, to visit such counties as we considered necessary to examine the method of taking care of the indigent sick and the management of county hospitals, and report. We visited and investigated Santa Clara, San Mateo, and San Francisco, and reported a plan for the management and furnishing this hospital, which the Board adopted. In everything connected with the hospital and the care and maintenance of the indigent sick, the Board of Supervisors have shown an enlightened liberality not usually found nowadays among such bodies. They have spared neither time nor trouble to do whatever seemed best for the county, and have quietly endured a large amount of misrepresentation and abuse.

The hospital was opened for the reception of patients the 23d of February, 1879. It is situated upon a hill, about a mile to the southeast of the Town of San Luis Obispo, at an elevation of about one hundred and fifty feet above the plain and two hundred and seventy-five feet above the level of the sea, which is about ten miles due west. There are two chains of mountains or high hills, with intervening valleys, which run parallel to the sea-shore, between the town and the ocean. Back of the town and to the east the Santa Lucia Mountains rise abruptly to an elevation of three thousand feet.

The hospital grounds contain about twelve and one-half acres. The soil where the buildings are erected is a sandy loam, with bedrock of recent sandstone from two to two and one-half feet below the surface. At the lower end of the field the soil is adobe. A ravine bisects the place and is utilized for drainage. Where the sandstone formation ends and the adobe begins several springs break out from below the sandstone. They are not used, however. Water is supplied in abundance from a spring on the mountain-side back of the hospital, about two thousand yards distant, and one hundred and twenty-five feet above the level of the buildings.

The plan of the hospital is substantially that recommended in the third report of the State Board of Health. It consists of a two-story executive building thirty-four by twenty-four feet, a kitchen and dining-room twenty-one by thirty-six feet, separated from the main building by a corridor ten feet wide, and one ward seventy-five by twenty-five feet. The plan adopted by the Board of Supervisors provides for two similar wards, one on each side of the main building. One only has been constructed. The other will be when necessary.

The main building has four rooms down stairs and four up stairs; those on the front twelve by fifteen feet, those to the rear twelve by fourteen feet. The ceilings down stairs are fifteen feet high; those above are twelve feet high. There are in each room two large windows, an open fire-place, and a closet.

The kitchen building has a dining-room fifteen by twenty-one feet, a kitchen fourteen by twenty-one feet, with butler's pantry, place for range, and store-room between. The ceiling is fifteen feet high.

The ward has a large room in the center, forty-seven by twenty-five feet, ceiling sixteen feet high, with nurse's room ten by seventeen feet

on one side of the entrance, and bath-room and linen closet, each ten by eight and a half feet, on the other side. At the rear a sitting room ten by sixteen feet, and a small bedroom ten by eight and a half feet.

There is an open fire-place at each end of the ward, four large windows (which let down from the top) on each side, and four ventilators in the ceiling. Upon the roof of the building (and also of the kitchen) is a "ridge" ventilator, twelve feet long, four feet high, also lattice windows in each end of the gable, so as to secure a free circulation of air above the ceiling and below the roof.

The floor is three feet above the surface of the ground, the space under the floor being ventilated by eighteen lattice windows. The ward is connected with the main building by a covered corrider ten feet wide, and is twenty-five feet distant from the kitchen. There are outside blinds to all the windows in the hospital.

The hospital is constructed of redwood—studding four inches, lathed and plastered with two coats, and calcimined. The wood-work is all plain finish. The floors are of well seasoned lumber, and when built were saturated with a solution of beeswax and rosin in linseed oil, put on boiling hot.

Thirty-nine feet to the rear of the kitchen is a small building used as a laundry, with stationary wash tubs, and hot and cold water, and a wood-shed. Twenty-seven feet still farther back, are two privies. They are placed over pits six feet deep, and are so constructed that they may be removed when the holes are full. Dry dirt is emptied into each vault once a week, and sulphate of iron every other day.

This modification of the dry dirt system was adopted after mature consideration as being the best method of getting rid of the excrementitious matter. The water-closet system was rejected because of the difficulty of disposing of the increased sewage which it entails, without injuring neighboring property. Dry excrement is comparatively innoxious; freely dissolved in water, and permitted to decompose in the inequalities of the tortuous channel of a ravine under a summer sun, it is liable to become a source of disease.

To the rear of the privies is a poultry-house and cow-yard. The grounds have been subdivided into pasture fields and a vegetable garden, and the approach to the buildings has been graded, and grass plots, etc., laid off. Some ornamental trees and shrubs have been planted. The design of the committee has been, however, to plant in the hospital grounds, as far as possible, such trees, shrubs, and flowers as are natives of the county. This plan could only be partially carried out this year, as the season was somewhat advanced when the building was completed.

The water supply is abundant and good. The waste water from the laundry, kitchen, sinks, and bath-room is conveyed in a four-inch galvanized iron pipe to the ravine, one hundred feet from the building, and is there absorbed by *reeds*, which have been planted in the bed of the gulch. This method of disposing of waste water I have used very successfully in my own yard for some years past. (I have had constructed a loose-jointed box or drain, placed about a foot below the surface of the soil, with laterals every eighteen feet, and have planted a tree at the terminus of each lateral. The trees grow luxuriantly, and there is no waste water.)

Every connection with the main sewer is trapped. The rain-water conduits from the kitchen and ward are connected with the sewer,

and a special ventilator (a three-inch tin pipe) joins the main sewer, where it emerges from beneath the ward, and runs up above the building.

The hospital is in charge of a physician, who receives fifty dollars per month. There is a Superintendent, on a salary of forty dollars per month, a cook and nurse at twenty-five dollars per month each.

The total expense for the first four months for subsistence, including *wood, washing, liquors*, vegetables, etc., everything, except salaries and medicines, was three hundred and forty-two dollars. The average number of persons fed was fourteen, making the cost per person about six dollars per month.

The hospital is furnished with gas-pipe, iron bedsteads, with strap iron bottoms. With each bed there is a straw mattress, a hair mattress, four sheets, two pillows, a pair of blankets, a counterpane; also a commode, chair, chamber, and cuspidor.

Contract price for building hospital	$5,966 00
Out-buildings	175 00
Price of land, twelve and one-half acres	850 00
Furnishing, plumbing, water supply, etc.	1,522 00
Total cost	$8,513 00
Amount which *ought to have been* in the Hospital Fund from sale of land	$8,225 15
The amount expended for indigent sick in 1875	2,419 00
The amount expended for indigent sick in 1876	4,412 25
The amount expended for indigent sick in 1877	2,769 83
The amount expended for indigent sick in 1878	4,166 00
The tax levy for indigent sick, 1877 (first time)	7
The tax levy for indigent sick, 1878	10

From the statistics on the last page, it appears that the total cost of the hospital was only two hundred and eighty-eight dollars more than the county received from the sale of land donated to the county by the town, and there are two lots still unsold. Too much credit cannot be given to Mr. C. W. Dana, who has for years contended for the erection of the County Hospital.

Respectfully, your obedient servant,

W. W. HAYS.

In relation to this hospital, Dr. H. Gibbons, having visited San Luis Obispo, adds the following:

So far from finding in or about the hospital at San Luis Obispo anything to censure, I was surprised at the excellence of the building and its management. It would be impossible to have a private dwelling in a better sanitary condition. Everything was clean and in order, and the drainage is perfect. Like the new hospital of Los Angeles, this, also, is due to the determined efforts of members of the medical profession. The cost of the indigent sick to the county is much reduced by the new arrangement. A complete meteorological record is kept by the Superintendent, under the instruction of Dr. Hays, and a summary of it published every week in the San Luis Obispo Tribune. I send herewith a history of the hospital, with a statement of expenses, etc., kindly furnished by Dr. Hays,

who appears to be devoted to the institution and to take as much interest in it as he could do in his own home.

There is one great evil which demands speedy attention by the authorities. The river runs directly through the city in a narrow and deep channel, and is entirely dry during the summer and autumn. All the offal and drainage from either side runs into the dry channel, where there is always an accumulation of offensive filth during the dry season. The wonder is that disease has not been generated from this source. Sooner or later the citizens will realize some disastrous results if the nuisance be allowed to continue. But the remedy is not an easy task. The channel is fifteen or twenty feet deep and forty or fifty wide, with almost perpendicular sides. In winter it is filled by the heavy rains and becomes a rushing torrent. It might be possible to construct a sewer or some sort of conduit in the bed of the river, with strength to resist the current. But this is a subject for the inhabitants to take in hand.

My impressions of the climatic and topographical conditions of this county were highly favorable to it in a sanitary point of view. The records kept at the hospital mark an equability of temperature, an absence of extremes, and a range at the point of the scale conducive to comfort and health. My acquaintance with the subject does not warrant a confident judgment; but I am inclined to the opinion that this county is not excelled by any other district in the State in its favorable influence in various forms of pulmonary disease. Besides, there are mineral springs in different quarters, the waters of which possess qualities decidedly beneficial both for internal and external use.

NAMES AND RESIDENCES

Of the Regular Correspondents of the State Board of Health, and of others whose contributions have assisted in the preparation of this Report.

Names.	Residences.
Dr. D. Ream	Yreka, Siskiyou County.
Dr. W. H. Patterson	Cedarville, Modoc County.
Dr. C. L. Anderson	Santa Cruz, Santa Cruz County.
Dr. C. B. Bates	Santa Barbara, Santa Barbara County.
Dr. F. Delmont	San Buenaventura, Ventura County.
Dr. O. S. Eddy	San Buenaventura, Ventura County.
Dr. H. S. Orme	Los Angeles, Los Angeles County.
Dr. E. A. Kunkler	Placerville, El Dorado County.
Dr. Q. C. Smith	Cloverdale, Sonoma County.
Dr. J. H. Crane	Petaluma, Sonoma County.
Dr. G. M. Wells	Sonoma, Sonoma County.
Dr. B. S. Young	Santa Rosa, Sonoma County.
Dr. H. C. Crowder	Bloomfield, Sonoma County.
Dr. C. A. Kirkpatrick	Redwood City, San Mateo County.
Dr. M. C. Parkison	Antioch, Contra Costa County.
Dr. F. C. Durant	Folsom, Sacramento County.
Dr. M. Baker	Visalia, Tulare County.
Dr. J. M. Briceland	Shasta, Shasta County.
Dr. A. B. Caldwell	Marysville, Yuba County.
Dr. H. Worthington	Los Angeles, Los Angeles County.
Dr. M. M. Granniss	Visalia, Tulare County.
Dr. Alemby Jump	Downieville, Sierra County.
Dr. H. J. Crumpton	Lakeport, Lake County.
Dr. Thomas Ross	Woodland, Yolo County.
Dr. M. Gardner	Davisville, Yolo County.
Dr. W. C. Baylor	Willows, Colusa County.
Board of Health	Colusa, Colusa County.
Dr. W. T. Bell	Winters, Yolo County.
Dr. J. Bradford Cox	San José, Santa Clara County.
Board of Health	San Francisco.
Board of Health	Stockton, San Joaquin County.
Board of Health	Sacramento, Sacramento County.
Dr. Wm. Curless	Truckee, Nevada County.
Dr. W. D. Rodgers	Watsonville, Santa Cruz County.
Dr. R. F. Rooney	Colfax, Placer County.
Dr. Geo. S. Farley	North San Juan, Nevada County.
Dr. G. W. Davis	Chico, Butte County.
Dr. W. R. Fox	San Bernardino, San Bernardino County.
Dr. W. W. Hays	San Luis Obispo, San Luis Obispo County.
Dr. G. L. Simmons	Sacramento, Sacramento County.
Dr. K. D. Shugart	Riverside, San Bernardino County.
Dr. J. T. Wells	Bakersfield, Kern County.
Dr. W. C. Jones	Grass Valley, Nevada County.
Dr. G. W. Westlake	Red Bluff, Tehama County.
Dr. F. Walton Todd	Stockton, San Joaquin County.
Dr. H. F. McCormack	St. Helena, Napa County.
Dr. H. M. Kier	Knight's Landing, Yolo County.
Dr. John W. Reins	Crescent City, Del Norte County.
Dr. James Frost	Vallejo, Solano County.
Dr. T. C. Stockton	San Diego, San Diego County.
Dr. W. C. Hook	Oakland, Alameda County.
Board of Health	Sonora, Tuolumne County.
Dr. Walter Lindley	Los Angeles, Los Angeles County.
William Bassett, C. E.	Sacramento, Sacramento County.
Dr. J. B. Gordon	Santa Rosa, Sonoma County.
Dr. Martin Baker	Visalia, Tulare County.
Dr. L. S. Rogers	Bakersfield, Kern County.
T. W. Morgan, C. E.	Oakland, Alameda County.
Dr. Lewis Leach	Fresno, Fresno County.
Dr. G. A. Shurtleff	Stockton, San Joaquin County.
Dr. E. T. Wilkins	Napa, Napa County.